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# AMERICAN MACHINIST

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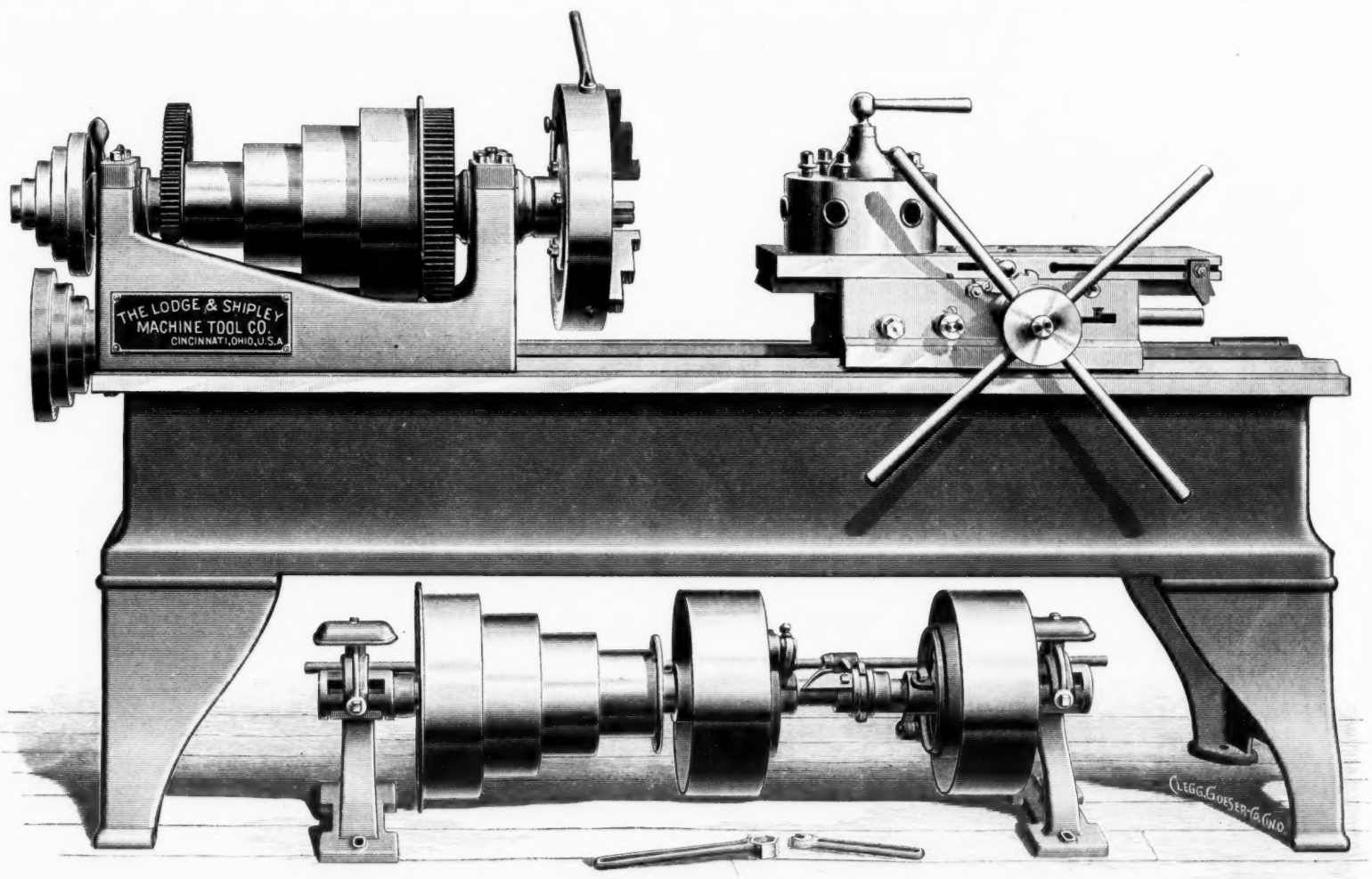
## Twenty-two-inch Turret Chucking Lathe.

The accompanying illustration is of a turret chucking lathe, recently brought out by the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio.

In its design no attempt has been made to depart from standard and approved practice in such machines, but it has been made sufficiently strong and powerful to do the heaviest work coming within its capacity. It is found entirely practicable, for instance, to use a 4″ pipe tap in the machine, and do a good job of tapping with it.

The lathe swings 22″, has 7-foot bed and




TWENTY-TWO-INCH TURRET CHUCKING LATHE.

is back geared; it is driven by a four step cone for a 4″ belt. The spindle is crucible steel. Front bearing 3¾″x5½″, back bearing 3½″x4″. The bearings are phosphor bronze.

Turret is 13″ in diameter, and is made to revolve automatically or by hand. When made to revolve automatically, a lever is provided to withdraw the locking pin by hand, so that turret may be revolved at any point of its stroke. This avoids having to move the slide back to a given point, and permits of using one, two or any number of tools and moving them backward or forward, as the nature of work may require.

It is provided with four changes for power feed, and an adjustable automatic stop for same. The feed is particularly powerful and substantial.

A four jaw combination chuck is fitted to the machine, which is in every size and proportion a 24″ chuck, except that its diameter is reduced to 18″, thus giving great gripping power and good wearing qualities.

There is a reversing countershaft, with friction clutch pulleys 14″ diameter.

The machine weighs 3,000 pounds. It is made also of 24″ swing.

## Die-sinking Machines—Open and Closed Dies—Modern Machinery.

BY B. F. SPALDING.

One of the essential elements of a machine for sinking dies by cutting the stock out from the impression seems to be a slide bed with two lateral movements at right angles to each other, and another is a revolving spindle perpendicular to the bed, with facilities for graduating the distance between the two. Other movements of nearly equal importance are sometimes incorporated with the machine. All are modified and adjusted for the purpose proposed, and every adjustment provided which will conduce to their proper employment. The gratifying result of the whole combination is a machine which is not duly appreciated, but which is constantly developing unlooked-for capabilities. It is like a trade of which those who have worked at it the longest, and learned it the best, will say: "We are always finding out some new thing about it."

Die-sinking machines, as now made, are intended to be used, whenever occasion requires, as copying machines. They are so arranged that a model die may be fixed on the bed which carries the die which is to be formed, and hence these two dies will be moved in concert, holding at all times the same position relative to each other. A If there is any variation in their size, there will be a uniform but not a proportional difference of size in the impressions of the model and the made die.

As the arrangement of motions in this machine is such that it can present an object to the grubbing of a rotating cutter in every direction, horizontally as well as downwards, and as the cutter will mill away and remove any stock so presented, it is evident that with properly constructed cutters it can produce work of any shape or contour or of any sharpness of angle, except such inside angles as are consequent upon its horizontal motions. The acuteness of these, if produced by a rotating cutter, is limited by the radius of the circle of the cutter, but if it is necessary or appears expedient to cut such angles with the machine, rather than to dress them out by hand, a chisel may be substituted for the mill, and the stock from any corner may be removed with a light planing or splining cut which does not strain the screws more than their ordinary employment. This application was especially provided for on the original "Index" or universal milling machine. The spindle had a ball and socket connection with a stout wrought-iron lever by which endwise motion could be communicated.

The quality of work which the die-sinking machine is intended to do requires that it should be made with such accuracy that it will fashion work with undeviating precision. It is in fact so well made that with well-ground cutters the bottoming cut leaves a surface as seemly and smooth as though it had been stoned. Parties have fitted the three actuating screws with micrometrical indices by which its motions in any direction may be gauged and stated very minutely, and have so balanced its movable parts as to render it delicately sensitive to the touch. With these nice appointments, determinations and susceptibilities, it is competent to as fine performance as the copying machine, noted in London a hundred years ago for its work in copying medallions, which must have had similar capacity of motion, and have substituted a fixed graver for a revolving cutter to have secured its finest effects.

These remarks about the die-sinking machine are not intended for those who know it, but for those who know it not. It is a prompting of business instinct to seize upon the advantages to be derived from the employment of machinery as soon as they are shown to exist, with the same avidity and for the same cause that specks of gold are picked up wherever they can be found. So

was the world's mass of gold gathered, and so individual wealth is accumulated.

In most shops where drop dies are used it will pay to use closed dies on some forgings, even when with good contrivance most of the work can be done with open dies. The difference between a closed die and an open die is this: In a closed die the stock cannot escape but the overplus, or whatever is taken into the dies more than enough to fill them, is thrown out as a fin, and is removed by trimming in a punch press or with a chisel, or by grinding, but in open dies the stock is worked sidewise and edgewise successively until it is brought to the proper size and shape, and the overplus stock, if any, is worked out at the ends, and simply requires to be cut or broken off. It will be observed then that the open dies only require to have the bottoms of the impressions made to the right profile because these only impress the form upon the stock, but in closed dies the impression must be correct on all sides, because the stock fills the die and the shape of all sides is impressed upon it. As there is very little strain upon open dies they can be made of cast iron often with great advantage and take the proper form from the mold, but closed dies have to sustain an enormous strain and therefore have to be worked out from solid steel.

It is advisable in many cases, and especially when unskilled labor is employed at the drop, to use closed dies when the extra cost of dies, the cost of trimming, and the expense of extra waste of stock does not make the full cost of the forging greater than it would be if made with open dies.

Some work which can be forged either way may be made with one or two blows with closed dies, while it would require more than twice as many to make it with open dies, and yet it may be cheaper to use the open dies on account of saving stock, for being struck repeatedly first on the side and then on the edge, the extra stock is forced out at the end, and, being left on the bar, goes into the next piece instead of being trimmed off as a fin, which would be necessary if it had been made in a closed die. The cost of trimming is also saved by the use of the open die. The cost of forging is to be reckoned from the bar to the piece delivered as a complete forging, and as it includes everything expended to produce it, the cost of all dies, trimming as well as forging, must enter into the account.

In a majority of shops where drops are employed it will pay to have a die-sinking machine, not only that the cost of dies is cheapened by its use, but also because dies can be made with it which could not very well be produced without it by mechanics not skilled in the specialty of cutting out accurate impressions in steel. This increased facility of making trimming as well as drop dies induces a greater use of the drop and utilization of the advantages it affords of producing uniformity of pieces. Everybody ought to know at this day that pieces so perfected are cheaper than hand forgings, and not only in first cost, but also in saving much of the labor which would have to be spent on them if they were not so shaped.

Some men seem to judge of the value of a machine to them by the amount of time they can keep it running. They don't want to buy a tool they cannot keep constantly employed. That is not the criterion to go by. Tools are not to be valued in proportion to the amount of time which they must be employed to do the work, but to the amount of time in which they can remain unemployed and still do the work. A manufacturer would hardly think it wise to put a large portion of his working capital into a machine that he would only use two weeks out of the fifty-two in the year, and yet thousands of small capitalists have invested millions of dollars with ample profit in just such machines. Where are the machines? Standing outdoors in the fence corners all over the country. Agricultural machines? Yes; farmers find that it pays them to have tools to do their work when the field is ripe for the harvest, and to do it quick, and then let the tool remain idle until it can show its worth again, and manufacturers can learn the same lesson.

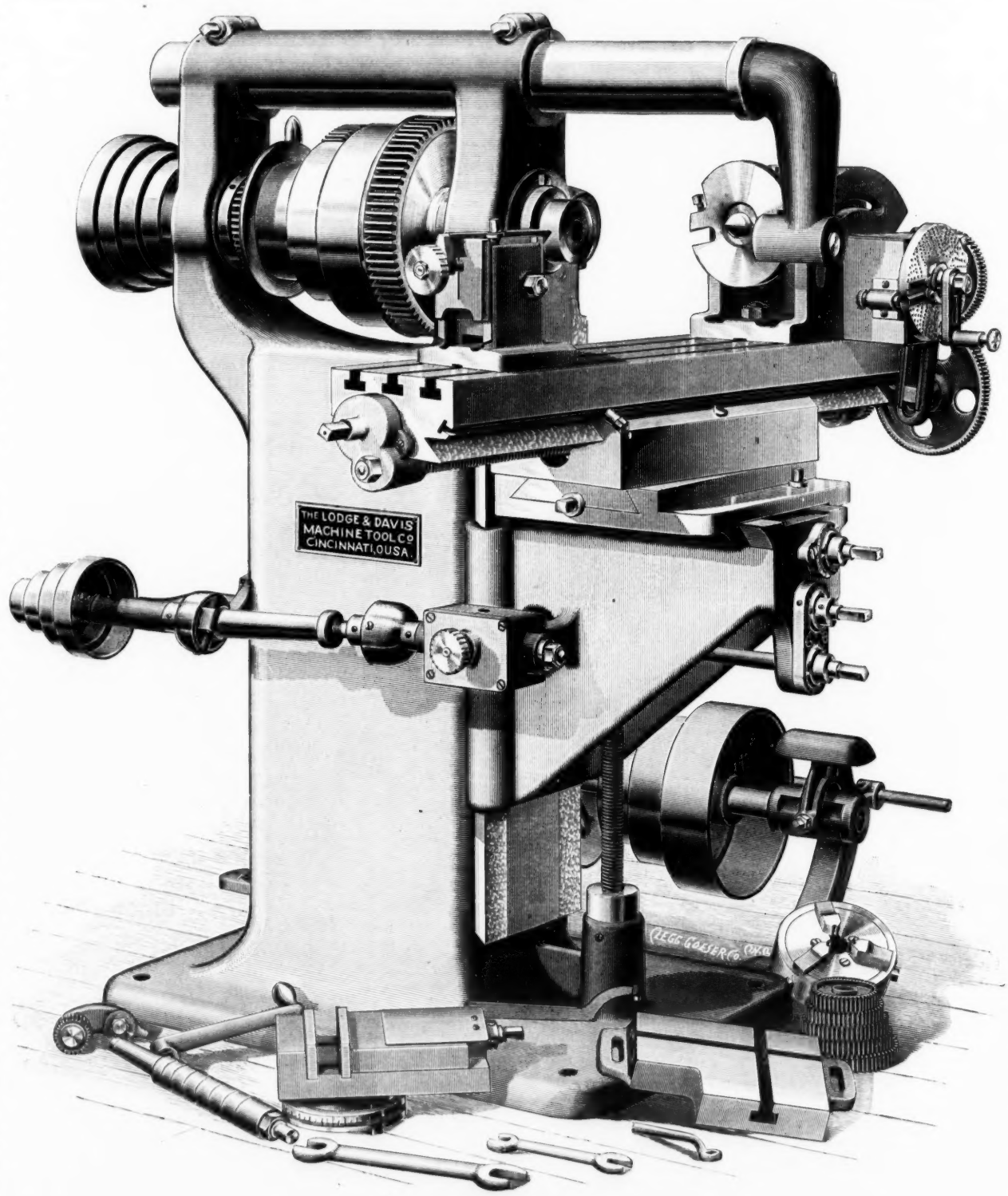
It may be observed that the die-sinking machine is not of the kind which is improved by standing outdoors in the fence corners; the best of care is none too good for it, nor is the most intelligent and careful man too good to have the charge of it.

Circumstances are of frequent occurrence which illustrate the benefits which may result from the ability to make uniform forgings. One instance of many like it was where a large number of machines had been manufactured and sent out by reputable parties. It was an old standard machine, but they had made some slight alteration in it, and as is often the way with slight "improvements," this one was found to have spoilt the machine, for the "slight" alteration in one part had caused a great alteration in another part. Various plans were devised to remedy the defect, but all involved too much trouble, until at last it was discovered that a single forging, if made of a peculiar shape, would answer the purpose, but the shape was so intricate and difficult to make by hand that it would not have been thought feasible to make it if it had not been pointed out that drop dies could be cut with which the pieces could be made with uniformity at a moderate expense. This plan being adopted and the pieces sent out the defect was remedied, and the expense of returning the machines for repairs was avoided. This is simply the old story of the advantage of interchangeable parts; this version of it is only to show that the benefits of the system were obtainable because the means were right at hand to secure them at once.

This suggests an illustration of that other old story, the value of prevision and supervision. It may seem exaggerated, but it is a cold fact. Some men were once grouped together in a manufacturing company who had struck a business bonanza—a mine of wealth. The golden sands had run so freely that it hadn't been necessary for them to know anything about the real economies of manufacturing, and, of course, when they felt inspired to practice something of the kind in the name of "business," they saved at the spigot and slopped over at the open head of the barrel. Without bothering their heads much about the matter they carelessly classed the cost of supervision and of tool-making together, and both as unprofitable expenditure, or as one of them put it: "As a standing expense; like the brick walls of the shop."

One day it happened that a man came along whose eyes set so far back in his head that whatever he saw affected his brain. He looked a little into the way these men did business, and finally told them that they were not paying out enough for tools and superintendence, and he could prove it. They took an uncanny faith in him, told him to go ahead, paid him the salary of a cabinet minister to manage the mechanical department of their business, and he permeated the whole establishment with his presence, as the sunlight floods the entire planetary system. He put thousands of dollars worth of tools into the tool-room, and set to work six times the number of tool-makers they had employed before. In short, he modernized to the last extremity. The latest and best and most efficient tools and methods he would have, and he did have.

What is the result of this headlong expenditure? It is that the average cost of the product of the establishment is reduced to about a third of what it was when he assumed control; the demand for the machines they make has kept pace with his improvements; the output has increased in proportion; more men are employed; the average of their wages is higher than ever; every one is satisfied, and prosperity abounds.




UNIVERSAL MILLING MACHINE.

Our esteemed English contemporary, the *Mechanical World*, highly commends the usefulness and value of Mr. Leicester Allen's series of articles "On the Cultivation of the Inventive Faculty," and in its issue of April 28 reprints the latest problem and invites its readers to submit solutions, which it offers to print together with some selections from the solutions given in our columns, so that comparisons may be made.

## Universal Milling Machine.

The accompanying illustration is of a universal milling machine, the general design and arrangement of which are well shown, and as will be perceived, it is designed for the heavier class of work done on universal milling machines.

The frame is cast in one piece with the uprights, which are bored to receive spindle boxes and overhanging arm.

The spindle, which is hollow, is made of hammered crucible steel, and runs in hard boxes of such form as to retain perfect alignment after considerable wear.

Chucks and arbors for main and universal

head spindles are interchangeable. Cone has four speeds for 3¼-inch belt, and is powerfully back geared.

The arbor is provided with collars for holding mills and cutters of various widths. It is drawn in and out of position by a screw operating from the rear end of spindle, thus avoiding the liability to abuse of the spindle in driving arbors in and out of it.

The platen is wide, contains three T-slots running its entire length, and has long bearing on cross-slide with suitable means of adjustment to take up wear. The feed is conveniently reversed by turning the knob at the side of the knee, and is automatically tripped at any point when feeding in either direction.

The knee is heavy, has a broad bearing on column, and forms a rigid support for cross-slide. All feed screws are indexed to thousandths of an inch.

The universal head swings 12 inches, and can be depressed 20 degrees below a horizontal, and 5 degrees beyond a vertical line.

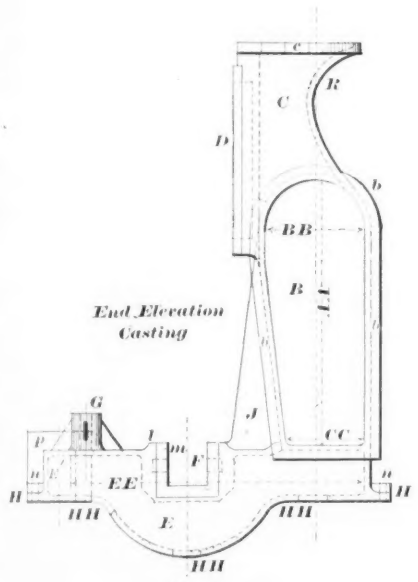
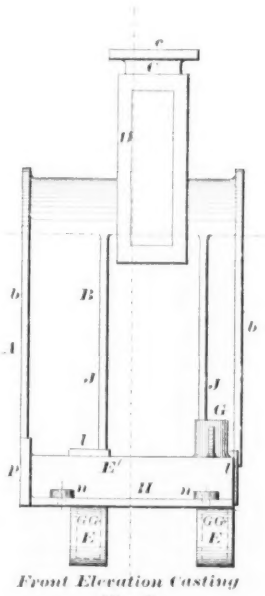
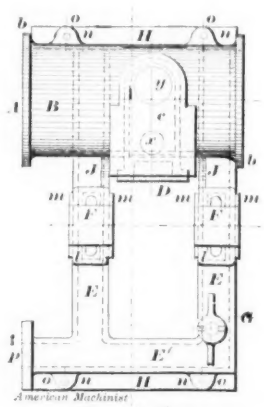


Fig. 1


Front Elevation Casting
Fig. 2



Plan Casting
Fig. 3

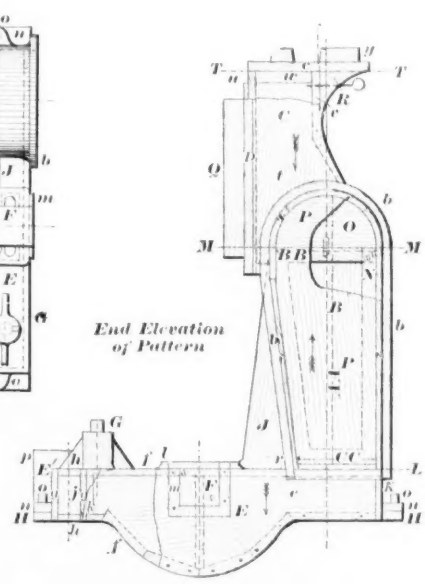


Fig. 4

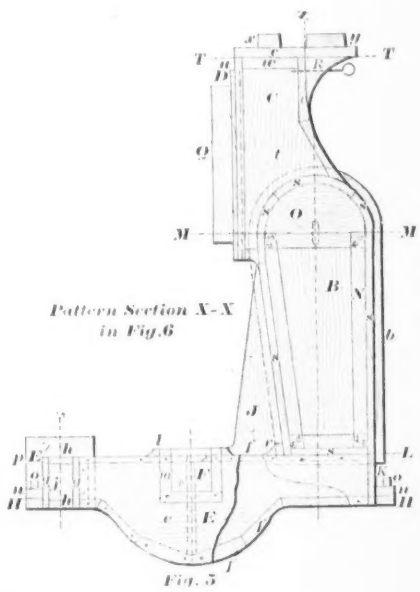
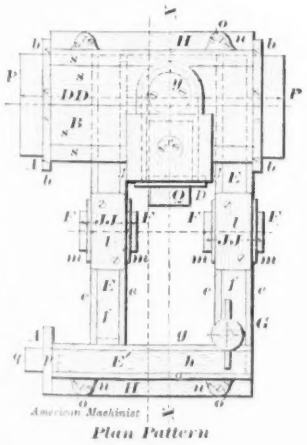
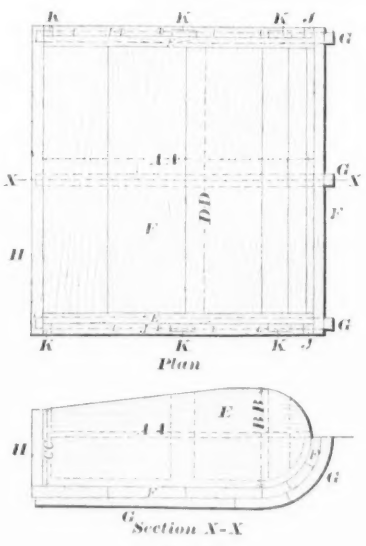


Fig. 5



Plan Pattern
Fig. 6


Plan

Section X-X
Fig. 7

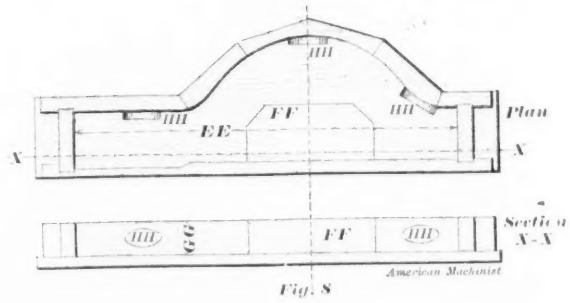


Fig. 8

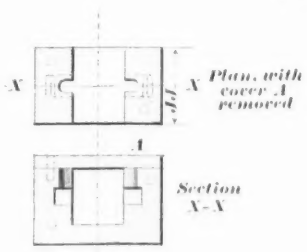


Fig. 9

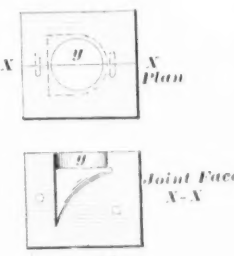


Fig. 11

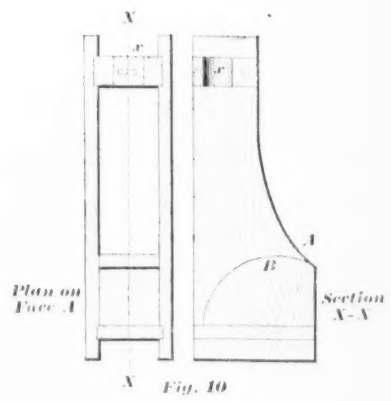


Fig. 10

The spindle is hollow, and will take 1-inch stock. The foot-stock is provided with means of adjustment. Suitable index plates, and change gears, both simple and compound, are furnished to adapt the machine to a wide range for cutting spur, bevel and worm wheels, and spirals from one turn in 1½ inches to one in 66 66 inches.

The vise has graduated base, and can be swiveled to any angle.

The machine is made by the Lodge & Davis Machine Tool Co., Cincinnati, Ohio.

## A Condenser Pattern.

BY JOSEPH HORNER.

Figs. 1–3 illustrate one-half of a condenser and base plate used for an inverted cylinder compound marine engine. Two such castings bolted together make up the condenser and base plate; the other half, bolted against face *A*, Figs. 2 and 3, being similar in the main, but modified in several ways, and having in addition the brackets for the bearings of the air and circulating pump levers. The principal parts in these figures are as follows: *B*, the condenser body or casing which contains the tubes; *b b*, its flanges; *C*, the pipe which serves as a standard for the cylinder and exhausting passage of waste steam into the condenser; *c*, the flange to which the cylinder is bolted; *D*, the facing for the slide blocks; *E*, *E*, *E'*, the base which carries the bearings *F F* for the crank-shaft; *m m*, facings for shoulders of brasses; *G*, a boss which carries one of the wrought-iron supporting pillars for the cylinder; *H H*, flanges for bolting down by; *n n*, bolt lugs; *o o*, their bolt holes; *P*, a flange for bolting to a similar flange on the other portion of the condenser; *J J*, strengthening ribs. The remaining figures need not be noticed until we go into pattern details.

Figs. 4, 5, 6 illustrate the construction of the pattern for this condenser part and base, and the main parts are lettered similarly to the corresponding parts in the casting, Figs. 1–3. Fig. 4 shows the pattern in end elevation, with some parts broken away to illustrate details. Fig. 5 is a sectional elevation taken along the plane *X—X* in Fig. 6, and Fig. 6 is a plan view.

It will be observed that nearly the whole of the parts are "boxed up," by the method universally adopted in large and heavy work. We will take the sections in detail.

Beginning with the base *E*, compare Figs. 1–3 with Figs 4–6. In the pattern there are sides *e e* extending the entire depth. These are kept at the proper distance apart, with strips *f f* planed to suitable width, and nailed between *e e*. The convex portion of the base is blocked round with stout pieces, butted end to end. Portions of the sides *e*, in Figs. 4 and 5, are cut away to show these blocks more clearly. The whole of the strips and blocks are nailed in place between the sides *e e* before the curves are finished, and before the flat boxed-up portions which form the base are finished to exact dimensions. After the pieces *H* are all nailed between the sides *e e*, the blocks *E E* are finished to exact thickness, are squared up, and the curves worked right through from side to side.

The transverse bar of the base *E* is made separately from *E E*, with sides *g g* and top and bottom *h h*, and ends *j j*, and is fastened to the ends of the two portions *E E*. *E* is screwed to *E E* with screws run in diagonally, or preferably with screws run into the ends *K* of *E* (see Fig. 4). The outer side *g* may be removed for the purpose of running in the screws. At the other end the rib *K* will be screwed upon *E E*, Figs. 4 and 5. Blocks *l l* will now be screwed upon *E E* to form that portion of the bearing which stands above the top level of the base; compare with Figs. 1–3. The facings *m m* will be nailed upon the sides of *E E*, and the prints *F* for the bearing seating screwed upon the facings. The flanges *H H* will be screwed upon the sides of *E* and of *K* respectively, and the hold down lugs *n*, with their prints *o* for bolt holes, nailed upon the flanges. The flange *p* and print *q* are screwed to *E* and the lug *G*, with its screwed on outside of the body. Against the faces of the condenser body the prints *P* of solid stuff are screwed. The ribs *J J* are screwed both to the base *E* and body *B*, and serve to keep these portions of the pattern in position during ramming, the screws being removed when the ramming is partly done, so leaving the ribs loose in the mold.

The portion *C* which carries the cylinder and the facings for the slipper blocks is also boxed up with sides *t t*, front and back *u u*, and top end *w*. The lower end is not filled up, being fitted round the convex top of the condenser. At the front and sides the pieces for the facing *P* are fitted, and the print *Q* for the recess is screwed upon the facing. The joint *M—M* is carried through both facing and print. The overhanging portion *R* is made separately from *C*, and jointed along the plane *S*; without this jointing it could not be withdrawn without considerable trouble. It is either screwed on loosely with removable screws or skewered on. Upon the top of *C* and *R*, the flange *e* carries the prints *x y* is doweled, being jointed along the plane *T*. This completes the pattern. It is best molded upside down, and the parting joints of the molding boxes are along the planes *L*, *M*, *T*, each pattern piece lifting in the direction indicated by its arrow, in Fig. 4.

The condenser *B* is made in two portions, jointed along the plane *M*, Figs. 4 and 5. This also is framed or boxed up, but in a manner different from the base. The larger portion of the body is built up on three cross frames *N*, framed together with half lap joints at the corners, and the smaller portion is built on solid cross-bars *O*, made solid because of their relatively small dimensions, and the upper and lower parts are doweled together in the plane *M*. On the cross frames *N* and bars *O* the outside of the condenser body is nailed, the strips of stuff *s* being from ⅜″ to 1′ thick only. The convex upper portion is framed in short sweeps, as indicated by the timber shading. The flanges *b* are made in narrow strips and print and brackets in the position shown in plan in Fig. 6; fillets *r* are screwed to the upper faces of *E E*, and serve as guides for setting the condenser correctly on the base in the mold, the condenser being made separately and jointed to the base along the plane *L*, so that with the work we have named the *base* of the pattern is completed.

We now take the core boxes. Fig. 7 illustrates the box for the body *B* of the condenser. Its width *A A* corresponds with the height *A A* inside the casting, Fig. 1, and the length *A A* of the print *P* in Fig. 4. Its depth *B B* and narrowest width *C C* coincide with the widths similarly lettered in Figs. 1 and 4, and its depth *D D* equals the total distance *D D* over the prints *P P* in Fig. 6. The two ends *E E* of the box are cut to the outline of the condenser opening, and their bottom edges rest upon a bottom board *F*, made in separate strips, and screwed together with the battens *G*. A side, *H*, confines the perpendicular sand at that part of the box. It is screwed to the ends *E E*, and removed after the ramming of the core. The sides *E E* are prevented

from being rammed outwards by means of strips *J J* screwed to the bottom board *F*, and they are stiffened with battens *K*. The upper portion of the core is strickled to shape by the top edges of *E E*.

Fig. 8 illustrates the box for taking out the base, the outlines of the core being shown by dotted lines in Fig. 1. The length *E E* of the core equals the length *E E* in Fig. 1, and its outlines, including that of the block *F F*, which gives metal round the bearing core, are seen to be identical with the dotted outlines seen in Fig. 1. Its depth *G G* equals the width *G' G* in Fig. 2. The three prints *H H* are for the reception of the oval cores *H H* in Fig. 1, which serve the function of chaplets or stops in the mold, and through which some of the air escapes from the main core. The construction of the box is apparent from the shaded figure, consisting of bottom board, sides and ends. There are two of these cores, and they abut against the core in the cross-bar *E'*. The latter is just plain rectangular, fitting at one end into the print *q* in Fig. 6, and having metal over it at the end opposite, I need not illustrate this plain box.

Fig. 9 is the core box for the bearing *F* in Figs. 1 and 3, and its cores fit into the prints *F* in Figs. 4–6, its total width *J J* corresponding with the width over the prints similarly lettered in Fig. 6. The box is divided and doweled along the middle plane *X—X* to permit of free delivery of the recesses for the tee headed bolts. The cover *A* is doweled also.

Figs. 10 and 11 are the boxes for taking out the hollow part of *C* in Figs. 1–3. A comparison of their outlines with the dotted lines in Fig. 1, *C*, and with the corresponding pattern parts in Figs. 4–6, will illustrate their relationships, and the timber shading will sufficiently illustrate their mode of construction. The curved block *B* forms that portion of the core which fits against the body or main core of the condenser, and the hole *x* fits into the print *x* in Figs. 4–6. The end cross-bar of the box in which the hole *x* is cut is divided and doweled along the plane *X—X* for delivery of the core. The opposite end of the box is undivided, being only grooved and screwed into the box sides. The box, Fig. 11, cores out the portion *R* in Figs. 4 and 5, and the hole *y* fits into print *y* in Figs. 4–6. It is doweled along the plane *X—X*. I need not illustrate the box for taking out the recess in the facings *D*, as it is only plain rectangular, nor the core box for the boss *G*. The latter is a plain round box with the cotter way seen in Fig. 1 cut out in the joint of the box.

## Twenty-inch Engine Lathe.

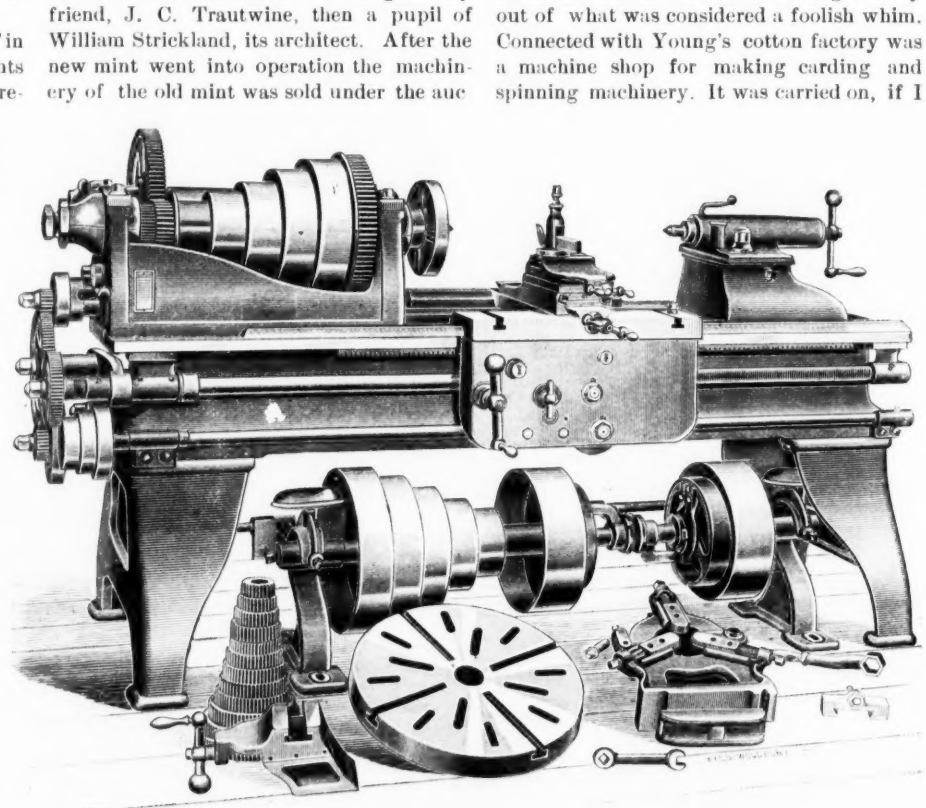
The accompanying illustration represents a new 20-inch engine lathe recently brought out by F. E. Reed & Co., Worcester, Mass.

The bed is of unusual depth for a lathe of this size, and is well tied together. The outside Vs of the bed, on which the carriage moves, are much larger than the inside Vs, for the purpose of giving larger bearing surface for the carriage to move upon.

The live spindle is made from a crucible steel forging, and runs in boxes made of cast-iron lined with genuine babbitt metal, which is put into the boxes in such a manner that it cannot work loose. The front bearing is 3 inches diameter by 6¼ inches long.

The cone pulley has five sections, the largest of which is 13½ inches diameter for a 3 inch belt, and the spindle is strongly back-geared, and special care has been taken to make these gears so they will run smoothly.

The rest has long bearings on the Vs, and is securely gibbed front and back. The feed works are driven by an independent rod and patent friction feed, and by a patent variable feed, so that a large range of feed can be obtained. The power cross-feed is so arranged that the gearing does not lock in with the lateral feed and break out the teeth of the gearing in case both feeds are put in operation at the same time. The lead screw is made of steel, and is operated in connection with an open and shut nut. The rack pinion is arranged to disengage from the rack when cutting screws. The footstock is stiff and strong, has a long bearing on the bed, and carries a spindle of ample size. This lathe with an 8-foot bed complete weighs 3,100 pounds. With the lathe is furnished a patent friction countershaft having pulleys 14 inches diameter.



TWENTY-INCH ENGINE LATHE.

## Early Engineering Reminiscences.

BY GEORGE ESCOL SELLERS.

THE UNITED STATES MINT—II.

When the present U. S. Mint in Philadelphia was built it was furnished throughout with entirely new machinery that the old mint might be kept in full operation during its construction. The new machinery did not differ in any essential points from the well tried of long service in the old, only differing as to amount to meet the requirements in increased coinage. With this new machinery we had nothing to do. I felt great interest in the building as it progressed, inasmuch as it was under the charge of my friend, J. C. Trautwine, then a pupil of William Strickland, its architect. After the new mint went into operation the machinery of the old mint was sold under the auctioneer's hammer, mostly by weight as old metal. We became the purchasers of the rolling mill department with its shafting and connected machinery. The housings, rolls, etc., did not go into the melting furnace, but were refitted as a train of rod rolls and went into service in a Pennsylvania rolling mill.

In giving such recollections as may occur to me of the evolution in the various processes up to the final steam coinage, I shall endeavor as far as possible to clear them of the accumulated cobwebs and dust of time. These advances and improvements commenced during the administration of Dr. Samuel Moore as director, who first saw there was room for improvement in the melting and refining department to secure more uniform results and to save waste. For the purpose of learning what had been done, both chemically and mechanically in the European mints and metallurgical establishments, that they might be introduced in the U. S. Mint, he obtained permission to appoint an assistant assayer and an appropriation to send him abroad for a thorough investigation of methods. For this purpose my mother's half brother, Franklin Peale, was selected and appointed and went abroad on the mission in May, 1833, and he was engaged in the investigation about two years, reporting progress from time to time. On his return he took his position in the mint as assistant assayer, and at once inaugurated the most important changes in that department, which eventually led to vital changes in coinage from hand to that of steam power, but of this further along. To show the fitness of Mr. Peale for the position which led to such important results, a résumé of his early training will not be out of place here.

His father, Charles Wilson Peale, had peculiar ideas as to education; he believed in never opposing but in every possible way assisting and encouraging the child's natural bent. I can recall but one instance that he did not carry that out—that was in the case of Lineaus, a brother of Franklin, whose bent was military. An appointment to West Point, made and earnestly urged by Mr. Jefferson, was declined, in which I think Mr. Peale's third wife, who had the bringing up of the children of the second, who was Franklin's mother, had much to do, as she was a Quakeress. I have often heard my grandfather regret having tried to make a boy, whose bent was towards the army, a cotton spinner, but Franklin of his own volition had gone to the cotton factory of William Young, on the Brandywine, in Delaware, to learn the trade. Mr. Young was a friend of the family and great confidence was placed in his counsel and advice in leading the boy out of what was considered a foolish whim. Connected with Young's cotton factory was a machine shop for making carding and spinning machinery. It was carried on, if I am not mistaken in the names, by the brothers Hodgson; into this Franklin soon drifted. They were for the time considered very fine workmen when hand tools had to be depended on. I have heard one of the brothers say that within a year Franklin with cold chisel and file on hand lathe work far excelled them. When Franklin became satisfied that he had learned all he could in that establishment he returned to Philadelphia and went to work with my father, who was at that time a member of the old firm of N. & D. Sellers, at making machines for cutting and bending wire into card teeth. While working at that my elder brother worked with them, and I got many good lessons in the handling and use of tools. He was a skilled workman as a turner on the foot lathe with hand tools. I have rarely seen his equal, never his superior. In that shop to show his skill he turned one of those wonderful ivory balls—three skeleton balls one within the other—in imitation of those brought from China. As to filing flat surfaces, to show and explain how a file should be shoved to avoid rocking I have seen him file a piece of metal over two inches broad, so that when a straight-edge was laid on it bore on the extreme outer edges, and light could be seen under the center; in other words, filing to the curvature of the file he was using. At a later period when he was manager of the Philadelphia Museum he delivered such chemical and other lectures as could be made interesting to the general public by brilliant experiments. He also exhibited many ingenious automita of his own invention and construction. About the same time he delivered at the Franklin Institute a course of lectures on machinery, illustrated by models and movable card drawings. About the time the accounts came from England of the locomotive experiments on the Liverpool and Manchester R. R. that excited great interest in all civilized countries, Mr. Peale, to profit by the excitement and general interest, designed a model locomotive, based mainly on the description of the Ericsson engine in the Rain Hill tests. This working model was built by Matthew W. Baldwin, and for a time was a great attraction, making the circuit of the museum rooms, that at that time were in the Arcade Building, drawing two miniature cars, each seating four persons. At the time this model was built Mr. Baldwin was carrying on the business of making bookbinders' tools and copper cylinders for calico printing. No doubt this little locomotive may safely be considered as the nucleus of the great Baldwin Locomotive Works of the present day.

Prof. Robert M. Patterson succeeded Dr. Samuel Moore as director of the U. S. Mint. He was a warm friend of Mr. F. Peale, and had great confidence in his philosophical and mechanical ability, and it was during his administration that most of the great improvements resulting from Mr. Peale's mission to Europe were introduced and carried to perfection in the mint. No one could have been better qualified for the directorship of the mint than R. M. Patterson, who it might almost be said was born in or to it—the son of Dr. Robert Patterson, who in the early history of the mint was for so long a period its head. Adam Eckfeldt as chief coiner had grown old in the service. This was before the time of that nefarious political doctrine, that "to the victors belong the spoils," had reached the officers of the mint, to whom of all others practical knowledge and experience is so essential; "it is practice that makes perfect."

Mr. Eckfeldt was a man of staunch integrity, a cautious, careful, orderly and painstaking man; he was not one of the dashing, pushing, inventive mechanics, though under his care many apparently slight improvements were gradually adopted that in the aggregate amounted to a great deal in the economy of working. He was by no means deficient in inventive ability. I have more than once heard that leader in fire engine building in Philadelphia, Patrick Lyon, give Mr. Eckfeldt the entire credit for the long-end levers with folding handles, that superseded the side-levers on the old-fashioned fire engines, and by which the operators applied their force easier and in a more direct manner. Although Pat. Lyon was the first to introduce them he always spoke of them as the Eckfeldt levers.

Although Mr. Peal's legitimate duties in the mint pertained to the assay and refining department, and in which he was making great changes, including the introduction of the humid assay and some important changes in the details of refining to save labor and prevent wastage, the yellow smoke or fumes from the mint smoke stack at the time created quite an excitement among the residents of neighboring houses who knew nothing of the work the acids were doing. Mr. Peale's natural bent being mechanics his mind ran from his department to improving the machinery of the coining, and Mr. Eckfeldt availed himself of his suggestions, in a moderate degree. The first instance that I can recall to memory was to import a die sinking lathe. I do not recollect the name of the inventor, but it saved hand labor in duplicating dies. I shall have occasion to refer to this further on.

It was during the transition stage of the assay and melting that we were first called on to do any work for the mint. The first job was making patterns for and the castings for the new melting furnaces; also for a cupel furnace and a crushing and grinding machine, pulverizing the old black-lead crucibles to recover the metal that adhered to or permeated them, but we had nothing to do with the finer machinery until after our first locomotive was put in service on the Pennsylvania State road in 1836, some account of which I have given in the 16th and

17th numbers of "Early Reminiscences" in the numbers of October 31st and November 7th, 1885. Dr. R. M. Patterson and F. Peale were of the company on an excursion to exhibit the performance of the engine to Lancaster, Pa., and return, a few days after which we received a note from Dr. Patterson requesting us to call at the mint. I answered this call, when Dr. Patterson placed in my hands a copy of a note he had addressed to M. W. Baldwin, S. V. Merrick, and to several other mechanical concerns, inviting proposals for the machinery of the branch mints, then about to be built at Charlotte, Va., and Dahlonega, Ga., saying that he should have addressed similar notes to us had he known that we were constructing machinery of the quality, as to workmanship, as was required. He knew that we were engaged in general foundry work, and for iron furnaces, rolling-mills and paper-mill machinery; that to his mind did not come up to the required standard, but on the locomotive excursion the workmanship of the engine had satisfied him of his mistake. He said bids would be received for any portions of the work and referred me to Mr. Eckfeldt, who was present at the interview, for specifications. He said bids would be considered for iron and brass castings, including patterns, finishing by surface measure; also by day's work, including use of lathes, tools, etc. This interview was on a Saturday afternoon; he regretted that the time was so short and that he had not called on us sooner, for if we desired to bid for any portion of the work we must do so by noon on Monday.

To my surprise, on reference to Mr. Eckfeldt I found that there were no drawings or plans of any kind. The specifications were all in writing, for the details of machinery reference was made to the machinery then in operation in the mint. That for the steam engine, gave diameter of cylinder, length of stroke, length of connecting rod, size and weight of fly-wheel, cylinder to be vertical, the general plan of engine to conform to that in the mint, which I think was a Rush and Muhlenburg engine, the successors of Oliver Evans. In addition to the shafting, pillow blocks, hangers, giving size and lengths, all of cast-iron, with coupling boxes, etc.; as to the rolling mill, draw benches, coining presses, milling machines, we were referred to those then in use.

I found Mr. Eckfeldt so opposed to horizontal steam engines that he would not listen to their being adopted; he had not had any experience with metallic ring spring packing, and he believed that with the ordinary hemp packing a horizontal cylinder would soon wear oval and the piston head could not be kept tight. The interview with Dr. Patterson and Mr. Eckfeldt was a long one, and it was after night when I got home at our works to consult with my brother; taking with me such written specifications as Mr. Eckfeldt had prepared—so meager and no time to refer to the machinery in use that I did not see a possibility of making estimates safe to bid on. The getting up of plans and patterns for the long-stroke vertical engine was out of the question. Having still on hand the old rolling mill machinery on which very trifling changes had been made for the new mint, a scale beam estimate would give a tolerable safe basis to bid on for that portion. We might secure the castings for the melting departments, for we had all the patterns for the improved furnaces that Mr. Peale was constructing in Philadelphia and expected to introduce into the New Orleans Mint, beyond which I did not think it possible we could secure any of the proposed work.

The *Manufacturer's Gazette* reprints as a leading attraction an article from the New York *Sun* on the "locomotive engineer," according to which a man in order to attain that position must first be a fireman, and then engineer in a stationary plant, after which by firing on a locomotive for about eight years he may hope to become an engineer when a vacancy occurs. As nearly as we can figure this out, no locomotive engineer can be less than 60 years old, and we wonder where all the engineers come from that are very palpably younger than this. And we also wonder why a technical journal that should make some pretensions to knowing something of mechanical matters should depend so much upon daily newspapers, which are notoriously ignorant of them.

## Special Radial Drill with Electric Motor.

We present with this an engraving of a special radial drill made by the Bickford Drill and Tool Co., Cincinnati, O., for the Crocker Wheeler Electric Co., New York City.

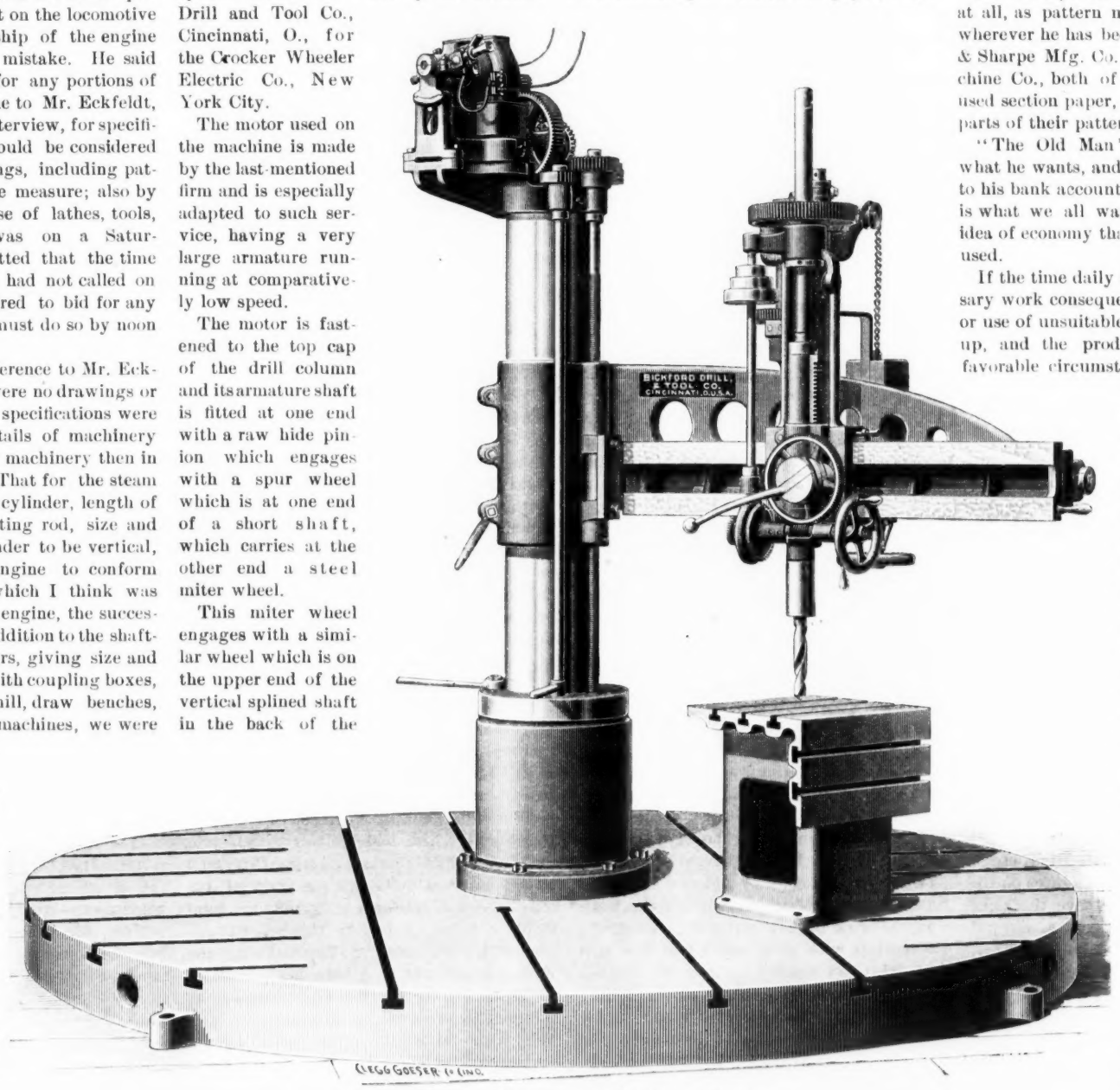
The motor used on the machine is made by the last-mentioned firm and is especially adapted to such service, having a very large armature running at comparatively low speed.

The motor is fastened to the top cap of the drill column and its armature shaft is fitted at one end with a raw hide pinion which engages with a spur wheel which is at one end of a short shaft, which carries at the other end a steel miter wheel.

This miter wheel engages with a similar wheel which is on the upper end of the vertical splined shaft in the back of the column. From this shaft the power is transmitted to the horizontal splined shaft in back of the arm, and from here to a short vertical shaft in back of the head which drives the spindle direct. On this latter shaft the back gear is attached, which arrangement very much reduces the strain on the long splined shafts, and permits some parts of the machine to be made lighter and neater than would otherwise be possible.

The arm of the drill can easily be swung around in a full circle and the base is also made a full circle, which gives the advantage of being able to set work on one part of the base while another piece is being operated upon.

The column of this drill consists of the inside column and the outside sleeve. The sleeve revolves easily on anti-friction rollers and has a bearing top and bottom, thus avoiding binding and springing. The switch board can be put at any convenient part of the drill to be within easy reach of the operator. The elevating and lowering of the arm is done in the same manner as on other similar drills and gives no difficulty at all to the motor. The test of this machine made at the shops of the Bickford Drill and Tool Co. has been very satisfactory and the drill did perfect work in every respect.




SPECIAL RADIAL DRILL WITH ELECTRIC MOTOR.

## LETTERS FROM PRACTICAL MEN.

### Drawing Room Appliances.

*Editor American Machinist:*

It was very gratifying to see so many expressions of opinion upon my article entitled "Section Paper and Its Correct Use," and I trust that the favorable criticisms will, in the minds of engineers and draftsmen, far outweigh the unfavorable, and that they will not be deterred by the few letters which spoke disparagingly of the paper, from giving it a fair trial.

I had supposed that it would have been apparent to every engineer that to lay out a mechanism upon cross section paper, where paper can be held securely with very slight pressure, whilst with a 45° triangle horizontal and vertical lines can be drawn.

In answer to Mr. Sauls' inquiry as to where the Chinese writing stick can be procured, I know of no manufacturer of them, but one can be very easily whittled from a piece of boxwood into the shape shown in Fig. 3, page 6, of the February 2d issue; care, however, should be taken in the selection of wood, as the hard sticks not only last longer, but will write much better than the softer ones.

The article by "Cascadilla," entitled "Use of Cross section Paper," states the writer's disapproval of the paper, and he says it is a positive hindrance in gear work. In this point I quite agree with him. A tin roof is an excellent thing for keeping rain out of a house, but the tin would hardly do to make a suit of summer clothes of.

He also says that shrinkage cuts no figure at all, as pattern makers go by dimensions, wherever he has been. Neither the Brown & Sharpe Mfg. Co. nor the Ferracute Machine Co., both of which firms have long used section paper, dimension the unfinished parts of their pattern drawings.

"The Old Man" writes that money is what he wants, and unless a thing will add to his bank account, to keep it away. Money is what we all want, and it was with the idea of economy that section paper was first used.

If the time daily expended upon unnecessary work consequent upon lack of system or use of unsuitable tools could be summed up, and the production under such unfavorable circumstances compared with the work obtained from a room where due attention was paid to system, and the suitable equipment of the men, the result would be truly astonishing. When we consider the important position in the engineering world which the designing and drafting room holds, it is surprising to find how much the whole arrangement, appliances and systems of one room differ from another. In this branch of the profession, which one might call the fountain head of all success, one would think that engineers would by now have come to acknowledge some particular system, and some special set of appliances as best adapted for accelerating correct designing and producing good work. Section paper in itself is only a small item, and perhaps its use would save only a very few dollars a year; nevertheless, if all these small items were as carefully considered as they should be, many of our firms would be much richer to-day than they are.

The choice of tables for a drafting room is a matter worthy of careful consideration. That the symmetry of the room may be preserved, they should all be of one height, and that height such as will suit the average man when standing. The height of tables now in common use seems to have been decided upon because it was half way between the height most suitable for sitting down and standing up to. The stools being non adjustable, and so high that a man's legs dangle in the air, he is constantly alternating between standing and sitting, and is never comfortable in either position. Reaching to the top of the board whilst sitting makes it necessary that he should take the weight of his body upon his chest, or hold himself in position by twining his legs about the framework of the stool; and standing to the work is a back-breaking business. In any case, he is rendered unfit

If reference is made to my article in the February 2d issue of this paper, page 6, it will be found that I said cross-section paper had been used to great advantage for all detail work, but I did not recommend the advisability of adopting it for universal use, nor did I credit the Brown & Sharpe Mfg. Co. with the first commercial use of it, as Mr. Oberlin Smith's letter stated. I said that the Brown & Sharpe Mfg. Co. were the first to adopt it for general use for detail work, and this I still have reason to believe is correct.

As to the necessity of fixing the sheet to the board to save the time of bringing triangle or straight-edge to the two points of a line, I have found the simple plan of fastening three thin india-rubber feet to a large size celluloid triangle to work very satisfactorily. This being placed upon the every distance can be easily read, would be much easier than where each dimension must be taken from a scale, but in this neither "Cascadilla" nor "The Old Man" seem to quite agree with me

for more than a few hours work at a time. The table should be made to suit a man while standing. The seat should be in the form of a high adjustable chair, having low back, and mounted upon rubber casters, as it is then an easy matter to move from one end of a large table to the other.

The most convenient form of table is one with a flat top, large enough to hold both drawing board and loose drawings. It should have a chest of drawers at one side, and be provided with places for a dust brush and file. The foot-rest should be a beam running the length of the open space beneath, and allow of adjustment up and down.

Upon the table there should be a light framework of wood, provided with sharp-pointed packing blocks to set it at convenient inclinations; upon this should be a new style Bergner board swiveling at the center; this allows it to be swung to any desired angle to suit the arm, or bring the upper portion of the board within easy reach.

Drawing paper should not be used directly after being taken from the roll, as the curling edges become quickly soiled, interfere with T-square, straight-edge and triangles, and are easily torn. The paper should be cut to the standard sizes, and kept in a drawer until wanted. This avoids the necessity of explaining to each new man the dimensions of an $\frac{1}{4}$ $\frac{1}{4}$, or $\frac{1}{2}$ size sheet, and keeps it always flat.

In general, it does not pay to require a designing draftsman to ink in his work, for this can be done fully as well by a cheaper man or tracer. Paper should be of a strong, high grade, so that erasing will not destroy the surface.

One of the best ways of securing a drawing or tracing to the board is to use small, copper tacks. They do away with the annoyance of the large-headed, old-style thumb tack, which greatly interfere with square and triangle. The chief objection to the tacks seems to be the noise made by driving; this, however, can easily be overcome by supplying each man with a small file or awl handle, the front end of which answers well for pushing them into place. The other end of the handle can have a small, slightly curved piece of steel inserted, by means of which the tacks may be readily withdrawn, saving broken fingernails and ruffled temper.

For quick work each draftsman should have a double-ended lead holder, that he may always be ready with a flat point for long fine lines, and a round point with which to transfer measurements from the scale, making sharp corners, figuring, etc.

In dimensioning, put as few figures on the drawing as possible. Never give the same dimension in more than one view, and put it where it is most likely to be looked for. Omit all foot and inch symbols, as they only add to the confusion of a drawing, and are practically useless. Up to two feet all dimensions should be given in inches. Beyond two feet, except in dimensioning pulleys, or where trade custom has fixed upon inches as the most convenient nomenclature, all figures to be in feet and inches.

If recessed triangles could be had, drawings could be kept much cleaner. Ordinary triangles other than wooden ones should be washed weekly.

In a finished drawing it is as well, for the sake of clearness, to give all center and pitch lines in solid red ink, dimension lines in solid blue, and the lines used for projecting parts to a convenient place for dimensioning in broken blue lines.

Parts to be operated upon in jig or fixture can best be shown in green ink, as they are then easily distinguished from the rest of the design. Arrow points and the figuring should be in black, as is customary, using the Chinese writing stick as above mentioned.

Every system should provide for pattern and forging numbers, and these should be carefully registered. The forgings should be separated into classes, and separate sheets used for each class, a note being made upon each sheet as to whether the pieces shown are to be made in the blacksmith's shop, cut off from stock lengths, or ordered elsewhere.

Each piece should have a suggestive nomenclature to indicate its place, and marked with the material and number wanted; the name should not contain too many words.

All drawings should be numbered, and an index kept as to the drawer in which each sheet can be found.

Finished lines can best be denoted by an f, x or ", rather than by an extra line in red ink, as these lines disappear in blue-printing and have to be redrawn on the blue-prints, work usually done by a boy, who generally makes mistakes.

Wherever a system is used there is danger of its being carried to extreme, and it then deteriorates into red tapism. This, perhaps, is worse than no system at all. The success of an engineering or any other business is greatly enhanced by everything that tends to cheaper production, and it must be with the object of cheapening the production of correct design and good drawings that the system in the drawing room should be formed.

Primarily, the drafting room should be comfortable; that is, well ventilated; the light, too, must be good. Then with good tools, and the judicious use of such labor-saving appliances as have been mentioned, good and cheap work may be expected. Section paper must be used in its proper place, and should not be allowed to develop into a hobby-horse, which, whatever its form, is sure in the long run to prove expensive.

Lastly, systems should not be allowed to extend too far in matters of design, as they are then more apt to destroy all originality than to accelerate any production whatever. It should rather be the endeavor in every drafting room to encourage original designing, so arranging the system that easy reference can be had at any time to what has already been accomplished.

H. M. NORRIS.

### Single Locomotives—About Emery.

*Editor American Machinist:*

I ought to have replied to Mr. Crane earlier than this, and hereby apologize for not having done so. I do not consider he is quite correct in saying that I was of opinion that small wheels could not make any kind of fast time, because this is not so. Over 20 years ago I have traveled behind an engine with 60-inch wheels at 60 miles per hour speed, and the engine was built before the year 1850. Nor did I mean to be understood as saying there were no brick arches used in America. Can Mr. Crane say, however, that the brick arch is of general application as it is here? If so, how is it that there was recently published an account of the addition of brick arches in Chicago to smoky locomotives with good effect, and how is it that with our smoky bituminous English coal we do not have black smoke rolling from the funnels here? What I had to say about the ill kept state of locomotives in America bore upon the question of the double crew system. You cannot run a locomotive all the time and keep it clean, but I don't pretend to say that the English plan is commercially the better plan, for it certainly keeps an engine idle when it could be at work earning money; but, after all, are not appearances worth something? No, I am not troubled with back pressure. It is not much heard of here, but, despite Mr. Crane's diagrams, it is a great deal talked of in America, and America has, I think, produced a bigger crop of ideas to improve it away than has England, where it might have been expected to be more felt by reason of higher speeds. I have the very best of reasons for knowing that back pressure is so much thought of in America that much money has been spent there to push inventions for diminishing it.

Now as to the indicated power of the English engine. This was 1,100 in the case I gave. The Empire State engine gave 1,300. It had bigger cylinders than the English engine, and was altogether larger and heavier, and it indicated 1,300 horse-power. Of what good was the extra 200 horse-power? The English train with 1,100 horse-power was far heavier than the Empire State, and was drawn by a single wheel engine. The weight of the Empire State train was about 280,000 pounds behind the tender; of the North Eastern train about 500,700 behind the tender, and the speeds were about the same.

My contention is that had American engines large single wheels and the English sanding blast, they would do their work better than now, and with less fuel. Why should they not?

Mr. Crane runs away with the difficulty-of-starting fallacy, and reminds me of a writer in one of your New York contemporaries, who stated that it took the Great Western 28 miles to get up speed. I feel at a disadvantage in arguing this question, especially in face of Mr. Crane's reiteration of the advantages of the small wheel for high speeds, and wonder why, if they are so good, the Empire State express is not run with a 40 inch wheel, and why 84-inch wheels are being got ready for it or similar American traffic. Let us see then what an American has said on the subject—Mr. Barnet Le Van, in the American *Engineering Magazine*, of March, 1893—Mr. Le Van's article is too long to reproduce bodily, but the following passages are culled from it, and I suppose Mr. Le Van knows what American requirements are, and is likely to know the weight of American trains, and is able to gauge the accuracy or otherwise of the oft-repeated statement that English passenger trains are so very light.

Well, Mr. Le Van says he "has covered the space of five miles at the rate of 70 miles an hour" "with entire absence of oscillation."

"Among the most important causes of friction are the coupling rods;" "is satisfied high speeds will be best accomplished with a locomotive having but one pair of driving wheels, similar to No. 5,000 built by the Baldwin Co." in 1880.

"Single locomotives are cheaper in first cost, more efficient and cheap in maintenance." "The majority of fast runs on English railways are made with 'single' locomotives, and their average loads are equal to the loads hauled in America, if not heavier than those of our fast trains.

"On one English railway the saving of fuel effected by single over coupled engines amounts to about 10 per cent. of the entire passenger locomotive coal bills."

Mr. Le Van refers to the "Ironsides" built in 1832 by Baldwin, which ran at 62 miles an hour, and to No. 5,000 of the Baldwin works, which had 78-inch wheels, and ran from Philadelphia to Jersey City, 89.4 miles, in 98 minutes, with a train of 148 tons total, and returned with 168 tons total in 100 minutes. I believe this was the engine which was sent to England with the Eames brake, and sold here, the purchaser giving $2,000 for her as scrap, because he thought there would be a copper fire box. Why it should have been scrapped I cannot understand, unless it was that no one cared to have an odd engine of the templet dimensions.

Then, Mr. Le Van instances the Carroll of Carrollton, which had 84-inch wheels of wrought-iron by Winans, which ran so well on the Boston & Worcester in 1849.

"The running in August, 1888, from Carlisle to Edinburgh, 100¾ miles, was made in 102 minutes 33 seconds, or at an average speed of 58.94 miles per hour by the Caledonian large wheel singles.

"The fast trains on the Midland average 240 tons (2,240 pounds), and the speed 50.7 miles, on a coal consumption less than 26 pounds per mile; the coupled locomotives of America never consume less than 50 pounds with this weight of train. The English engine on the P. R. R, which is virtually a single, uses 25 per cent. less coal than coupled engines doing the same work. The G. N. locomotives" (illustrated lately in the AMERICAN MACHINIST) "haul twenty-six 15-ton coaches with 26 pounds of fuel per mile."

Mr. Le Van fully replies to the objections raised as to want of adhesion, and states this is completely solved by the steam sanding jet.

He also says, "Our (American) locomotives are now built especially for starting trains, though this involves not 5 per cent. of the work to be performed, making them wasteful for 95 per cent. of the power." "Single locomotives haul 250-ton trains at 53 miles for 26 pounds, which would be hauled at 43 miles for 50 pounds by an American coupled engine. The English locomotive weighs 85,000 pounds, the American 100,000 pounds."

He concludes by saying that by the adoption of single engines, American fast trains would be run as fast as English trains, and save 50 per cent. in fuel on their present consumption.

After this information from an American authority we may well inquire again why it takes 1,300 horse-power to draw a four-car train in America? Why so many pounds of coal per mile, when trains of 250 tons (2,240 pounds) are hauled by English engines for 26 pounds per mile?

Why did Mr. Johnson, of the Midland Railway—the great English advocate of coupled engines—his line having heavy gradients, try one of his coupled engines without its coupling rods, and then begin to build singles which regularly haul their 240 tons at a mean speed of 53 miles per hour for 100 miles together? Because there is no starting difficulty with the sanding blast, and because for the sake of a quick start without sand it is not good practice to cripple an engine all the remainder of its journey. Mr. Crane says it may be possible to use a larger wheel to run lighter trains of four cars, and run them faster. My argument all along has been to use larger wheels on fast trains. I have said nothing of slow trains at 40 miles or less speed, and have always pointed out that for the highest speeds the excrescences of railroading in the shape of driving cars were a heavy tax. In this country of short distances it has been, until recently, our habit to lop off the excrescences and lay on the speed. The growth of the excrescences may, I suppose, be credited with the fact that we have no train scheduled to run at the mean speed of the Great Western trains of forty years ago, which ran from London to Bristol, 118 miles, in two hours from start to stop.

I might add that with the link motion at high speeds, and early cut-off, the high compression, which is the very good equivalent of back pressure, and serves much the same end, is intensified when the exhaust does not get freely away, and when there is a necessity to burn so many pounds of coal, this is effected by the sharp blast which helps up the compression.

Now, Mr. Crane is talking about defending the American locomotive, and says it needs no defense, but, if you please, who has attacked it? I certainly have not done so. What I have tried to do has been to point out how wrong it is to take an engine which is the growth of American circumstances, and has been evolved to meet certain conditions, which are mainly to draw heavy trains at moderate speeds, and to start and stop frequently; and to apply this same engine to conditions similar to those which prevail in an old settled country, without making any change in the structure and dimensions of the machine. Would Mr. Crane call it an attack on the English locomotive if some one were to state that the G. N. 8-foot single was not a proper machine to haul a train up Pike's Peak? Or is it a safe practice to run high speeds with small coupled wheels, having a regard for the coupling rods and pins?

Mr. Crane continues to speak of frequent stops, and says large wheels are unsuitable for this. I need again to remind him that I opened this discussion entirely on the question of high speeds, and no railroad runs high-speed trains with frequent stops.

If Americans could only bring themselves to believe English single engines do not simply stand still and slip, it would not be long before American locomotive builders would be asked to build such engines. Mr. Crane still doubts my facts. Let him therefore read Mr. Le Van.

In reference to the question of the distrib-

ution of load on the rails, to which I have alluded, as explanatory of the heavier haulage of American trains, I have made a few observations lately, and may add that short cars (30 feet in the body) are carried by six wheels, and cars about 40 feet long are carried by a pair of four-wheel trucks on some lines and by eight wheels on others. Longer cars have twelve wheels in all. There are, I know, twelve wheels under some American cars, but more often only eight, and considering that the English car is narrower and less lofty this would show a far heavier wheel load than even the lengths of car would indicate; quite sufficient perhaps to account for the heavier haulage, as pointed out by Mr. Crane, of a train of four cars (140 tons) as compared with one of 250 tons on the North Eastern.

It has been said that the special run of the Empire State express with 1,300 horse-power does not represent the maximum duty of the locomotive which did it. Whether this be so or not is of no moment whatever. My position is not to argue that English engines are more powerful than American because I am simple enough to still cling to the old notion that a locomotive cylinder develops power just according to its capacity and mean effective pressure, and I happen to have been connected with an American locomotive which developed 1,800 horse-power in the cylinders. Therefore I will leave this item and grant that 1,300 horse-power was not the maximum duty of the Empire State locomotive, but very clearly it was the power generated by an engine drawing a train of 140 tons very little faster than 1,100 horse-power drew a train of 250 tons; and this is what I am trying to show Mr. Crane I have all along been arguing, and he insists I am attacking the American locomotive. What I attack, if he insists on the word, is the bad distribution of the train load upon the track, the overloading of axles and the use of coupling rods on a high-speed engine, together with the use of too small wheels. So far indeed from attacking the locomotive as wasteful because it burns more coal and does less hauling my arguments go to show that the fault is not with the engine as indicated but with the practice that compels it to revolve at a speed unsuitable for it and pull a load whose resistance is needlessly great.

I must thank Mr. Walker for his information upon the emery question which corresponds with other knowledge I have received and noted in your columns as to the superiority of the magnetism of calcined emery as compared with raw. I am now trying to find why emery is calcined, if it is better or worse for the process. I have also to thank all others who have kindly volunteered information on this emery question in which I am still experimenting, and may some day be able to give back information in return.

At present I have found myself moving quite off the ordinary track, and apparently to advantage, but this may be merely my ignorance of what others have accomplished and I may find that either I am covering old ground, or that a discarded system is fitting a novel application.

W. H. BOOTH.

### Making Conical Springs.

*Editor American Machinist:*

J. M. W., Question 187, can bend wire into a helix by passing it through a system of three rolls, at some angle other than an angle of 90° to their axes. He can bend it into a true spiral by passing it through three rolls, one of which has a motion towards or from the other two. By combining both elements he can make conical spirals in a continuous coil, and then cut off as desired. The better way, however, is to buy them ready made from some one already in the business.

SUPERANNUATED.

### Gear Cutters—Patents.

*Editor American Machinist:*

In your issue of April 20, "Greko" wishes to know how clearance is got on a cutter for milling gears without thinning the tooth. It seems to me to be best answered by saying that what is called a tooth is really an *infinite* number of teeth, one back of another, each slightly lower than the other, though of exactly the same thickness; the fact of their being lower giving clearance, the only effect of grinding being to make the cutter of smaller diameter.

Fred H. Colvin certainly has the right idea of patents and their use, even if he is "jumped on" for his way of bringing it to pass.

H. P. F.

### Handy and Inexpensive Appliances.

BY PETER H. BULLOCK.

Those who manage steam plants know that there are always repairs to be made, and that accidents will happen that require immediate attention. The engineer who has the best tools and appliances at hand, and who displays the best judgment in their use, is the one whose plant is the least often disabled, and where to shut down for repairs to the apparatus under his charge is a thing almost unknown. The articles here described are simple, effective, inexpensive, and easily made. I use them all, and can assure any one having occasion to do work for which they are appropriate, that much time can be saved on many jobs over any other method or appliance known to me.

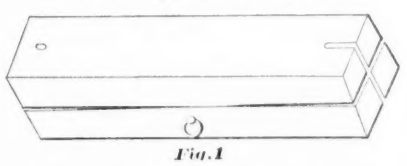


*Fig.1*

EASILY APPLIED BELT CLAMPS.

The clamps shown in Fig. 1 were designed for putting on a lot of new belts from 4 to 12 inches wide and directly from the roll, using pulley blocks to get the belt tight, and then cutting off just what was needed and lacing the ends together. They worked so well for this purpose that I utilized them for taking up belts already in place, using endless chain falls instead of rope pulleys. These clamps are simply pieces of 3x5 oak, planed slightly thinner at the ends to compensate for bending, and fastened with common 7x⅝ machine bolts. On one end the wood is slotted into the hole so the bolt can be taken out and the clamp slipped over the belt. Eye-bolts are put through the bottom half for hooking in the chain falls or other tightening apparatus. In using them it is not necessary to be very particular about getting them exactly square or central, for the blocks are put so far back from the ends that the belt can easily be held fair and square for lacing. I like this arrangement so much better than the slow working screws, that I have put four eye-bolts into my 40-inch clamps, and use a set of falls on each end instead of the discarded screws.

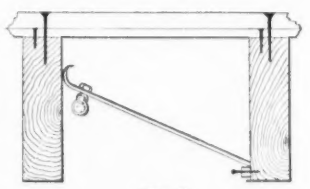


*Fig.2*

SOME BEAM GRIPS FOR TEMPORARY HOISTING.

It is frequently necessary to use blocks or falls for hoisting shafting or pulleys into place, and it is not always possible to find a good solid thing to hitch the top hook into.

Fig. 2 is a very handy rig to put in between floor beams or rafters. It is made of heavy flat-iron, one end rounded off and slightly curved upwards, and having a ring or link attached to a staple near the top or curved end for hooking the pulley blocks into. The other, or lower end, is left square and rough. To put this in place it is only necessary to tack a light cleat near the bottom of one beam for the lower end of the thing to rest on, while being put in place, for after the load is put on nothing in reason will pull it down. Of course, it must be used as shown; it works better that way, just the same as a shovel works best right side up. A friend saw mine and made himself one. He wished to raise a part of a machine from its frame and told his mechanic (?) about nailing on the cleat to hold the thing in place. The cleat was nailed on all right, in fact more solid than was necessary, but he put the bar in with the eye-bolt and link at the bottom and next to the cleat. The result was a scalp wound, an injured foot, and a broken casting worth forty dollars, and entailing over a week's delay. The rig was not to blame for the fault, the man didn't think; he ought to chop wood or drive a coal team. If the floor beams are light and the bar does not come near the X bridging, it is well to wedge a piece of wood endwise between the beam where the lower end of the bar comes, and the next timber, especially if the load to be hoisted is heavy, for the strain might be enough to press a light beam out of position.

Another portable and adjustable beam grip is shown in Fig. 3. It is made on the all-tongs principle, of 2½x⅝ machine steel, and will hold on beams from 2 to 12 inches thick. The teeth are on a curve so that, regardless of the thickness of the beam, one after another of the teeth are pressed into the wood as the load is increased.

This same rig reversed makes a good timber grip for hoisting beams or stringers, or for holding up one end of a timber while using it for a lever or purchase. I have made several especially for such use. To go with these appliances there should be in every engineer's tool-room several rope slings of various lengths and sizes to use on the rims and arms of pulleys, or on shafting when hoisting any of them into place. These slings being endless they can be slip-noosed on to anything, and there is no danger that some landman's knot will slip and break the article being hoisted, as often has

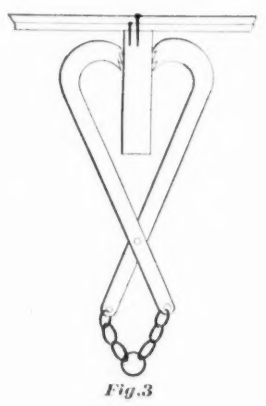


*Fig.3*

been the case. There should also be a few S hooks made of round steel, as there are lots of jobs where they are almost indispensable.

### High Duty Attachments for Pumps.

The regular monthly meeting of the Engineering Association of the South was held in Nashville, Tenn., April 13, 1893, with a good attendance, Vice-president William T. Magruder presiding. The feature of the evening was a discussion on "High Duty Attachments for Non-rotative Pumping Engines," led by Mr. L d'Auria.

Mr. d'Auria showed that, apart from any consideration relating to expansion, the aggregate weight of the reciprocating parts in Cornish, Bull and simple Worthington engines, respectively, is equal to 2.3, 1.0 and 0.1 of the load, although it could be made heavier without restriction; but with reduction of weight in these three successive types of engines, the rate of steam expansion had also to be reduced, it being possible to use in the Cornish engine four expansions, in the Bull but two, while in the Worthington with simple cylinder expansion was practically impossible.

Mr. d'Auria showed that the piston speed is affected by what he calls "effective weight," this weight being expressed by the sum of the products of each of the reciprocating parts by the square of the velocity of its center of gravity or gyration expressed in terms of the velocity of the plunger as a unit. In using steam expansively this force in the first part of the stroke is greater than the load and will perform an excess of work, "accelerative work." According to a law discovered by Mr. d'Auria, the mean plunger speed during the stroke in a non-rotative pumping engine equals

$$c\sqrt{\frac{\text{accelerative work}}{\text{effective weight}}}$$

the coefficient $c$ varying with the variation of the propelling force, in the average equaling about 4.8. By the application of this law Mr. d'Auria proved that a Bull engine could have been made lighter and yet use a higher rate of expansion than a Cornish, and that a Worthington engine could be transformed into a high duty engine by adding a reciprocating weight, about 7 or 8 per cent. of the load and moving with a velocity four times that of the plunger. This added reciprocating weight, which constitutes the d'Auria high duty attachment, Mr. d'Auria showed in the form of a liquid column. Thus a direct-acting plunger is attached to an extension of the piston rod of the pumping engine and moves in a cylinder of its own; at the ends of this cylinder the ends of a U-shaped pipe are attached and the cylinder and pipe are filled with a liquid. The area of the pipe being less than that of the plunger, the velocity of the liquid column is proportionally greater than that of the piston. Shocks due to excess of energy at the end of the stroke are prevented by passing the liquid around the plunger through small channels uncovered when the plunger, by this excessive pressure, passes beyond its usual stroke. Also, damage by sudden release of pressure, as by accidental breaking of the delivery main, is prevented by making the resistance to control a valve which throttles the passage of the reciprocating liquid. The law of piston speed was verified by a model in which the propelling force was a spring attached to one end of the plunger rod, the load being represented by a weight pulling at the other; these balance only at the middle of the stroke, the pull of the spring at the beginning is about twice that of the weight, and at the end only equals the friction of the working parts. When the apparatus was filled with liquid the piston made a steadier, longer stroke than when no liquid was used, showing the friction of the liquid to be insignificant. Diameter of plunger, 3.94 inches; of pipe, 2.06 inches; ratio of their areas, 3.65; weight of moving parts, 61 pounds; of water in the pipe, 51.5 pounds; hence effective weight with the water is $W = 61 + 51.5 \times 3.65^2 = 747$ pounds, and without the water is only $W = 61$ pounds. The accelerative work in both cases $Q = 4.84$ foot-pounds, and the length of stroke 0.46 foot. The velocity was with the water 0.383 foot per second, and without the water 1.33 feet per second. According to Mr. d'Auria's approximate formula:

$$V = 4.8\sqrt{\frac{Q}{W}},$$

the velocity equals 0.384 and 1.34 feet per second, respectively, showing a close agreement. Besides, the figures show that the effect of the water in the pipe was that of reducing the piston speed to about one-third that without water, and without appreciable loss by friction.

WALTER G. KIRKPATRICK, Secretary.

The Academy of Sciences in Turin announces that the ninth Bressa prize of 10,416 francs, for which all men of science and inventors of all nations are free to compete, is now offered—from January 1, 1891, to December 31, 1894. The prize will be given to whoever, in the judgment of the Academy, shall have, within the period indicated, made the most important and useful discovery, or shall have published the most profound work in the domain of the physical and experimental sciences, natural history, pure and applied mathematics, chemistry, physiology and pathology, geology, history, geography, and statistics. Any one wishing to compete must send his printed work—manuscripts are not accepted—to the President of the Academy. Unsuccessful works are returned, if it be desired.

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## The Chicago Exposition.

At this writing the great Exposition at Chicago is slowly settling down into working condition; settling down quite as fast as could be expected, considering the chaotic condition of the inside of many of the buildings. Much complaint has been made, and is being made as to the way matters in connection with the Fair have been managed. Of this it may be said that if the management was perfect there would be fault-finding. It is one of the prerogatives of human nature to find fault, and nothing can take away this right. There has been complaint from the beginning, and there will be complaint till the Fair is ended, and the last exhibit removed.

We do not, by any means, wish to be understood as saying that the management has been blameless. Abuses have existed—undoubtedly do yet exist. This has been especially noticeable in the opportunities that have been afforded for fleecing those who unfortunately felt impelled to eat and drink inside the enclosure. It is being corrected to some extent, but there is, so far as we can see, no reason why it should ever have been allowed to exist. It should, however—as in some sense an apology for those who had restaurant privileges on the grounds—be noticed that they assert that the only means by which they could get their supplies inside the enclosure made them cost fully twice as much as they would have cost them outside, elsewhere in the city. If this apology is not altogether a good one, yet if the facts are as they state, it has some weight. There has been careless management somewhere in regard to overcharges on the ground, but then as regards this and other things complained of, it must be remembered that the managers are only human, and that they have a big job on their hands; perhaps they gave too little thought to the fact that early impressions, especially if unfavorable, are certain to have a damaging effect. Allowance should also be made for the fact that international fairs are not things of every-day occurrence, and there are none specially trained to manage them in all their details. While it must be expected that errors will be made, particularly in the preliminary and early stages, the fact that there is so much to attend to should cover a good many errors of judgment. Many things that were not as they should be are being remedied, perhaps as fast as is practicable, and those who read the papers are quite sure to hear of all that is wrong, with a considerable margin of exaggeration.

If the attendance has not been as large as was anticipated, it has been large enough to show an interest that will, let us hope, later on bring it up to all that has been reasonably hoped for. The conditions have been such that many exhibits have not been in readiness, and this has kept many intending visitors at home. This is unfortunate because the cool spring and early summer months are better calculated to attract visitors than the warmer weather of the later summer months; it will undoubtedly decrease the total attendance to some extent. Then, as to the attendance in the early days, it must be considered that Chicago has not the population to draw from that Paris had, hence the local attendance, which at all great fairs is largely depended upon to swell the numbers during the first few weeks, could hardly be expected to be so great. We have not at hand the figures enabling a comparison to be made between the attendance for the early days at Paris and at Chicago, but should expect that it would be in favor of Paris.

The cost of living has, so far, been high beyond reason at Chicago, and this has undoubtedly been reflected in the attendance. It is doubtful if this high rate can be maintained; it is at least to be hoped that competition will bring about a reduction, which will be to the interest of the Exposition.

All these things, and the fact that the press of the country has kept the people well informed in the matter, have tended to keep people away from Chicago.

We are frequently asked as to the best probable time to visit the Fair. For those who can make a long stay, or for those who can go often, it is a good time now. Those who can only go for a short visit, and at a good deal of sacrifice, will do well to wait—wait until they learn, as they will, that the preparations are complete, or more nearly so than at present.

## The Honor of Draftsmen.

At this writing much space is being devoted in some of the papers to a rather sensational account of the alleged purloining of the drawings of one prominent electrical company by another, this being supposed to be accomplished by the treachery of a draftsman, who, while ostensibly in the employ of one company, was much more in the employ of the other.

The stealing of drawings and plans, in order to take an unfair advantage in business competition, is a particularly disreputable business, and we sincerely hope that whoever may be found guilty of doing it—or of being in any way concerned in it—will be justly punished, whether he be a poor and obscure agent or a wealthy and influential principal.

We hope, however, that it will turn out that no draftsman has been concerned in this, for it is particularly disgraceful for a draftsman to engage in any such business. The position of a draftsman is, and of necessity must be, a confidential one in nearly every case, and it ought to be considered a very gross breach of trust and confidence for a draftsman to let a drawing belonging to his employer, or any information which might be used to his disadvantage, go out in such a way that a competitor could take any advantage of it.

But on the other hand, it should be remembered by those who employ draftsmen that the position is a confidential one, and the wages paid and other attractions offered should be such that the class of men who can be trusted will be attracted. The employer who is determined to pay the very smallest wages that will secure men of any kind, must expect to get once in a while men who cannot be much relied upon, for men of proven high character, combined with the needed ability, can usually do better. We do not mean by this that the wages paid in the case mentioned were insufficient, but it would not be fair to call attention to the fact that a draftsman who betrays his employer is especially despicable without also on calling attention to the fact that the wages paid for a position of responsibility and trust should be commensurate with the responsibilities and the degree of confidence reposed.

It is quite certain, of course, that neither the General Electric, the Westinghouse, nor any other company can possibly pay any draftsman enough to make it really worth a draftsman's while to commit a breach of trust and confidence. Character and reputation are worth far more than any amount which any company can possibly pay for such a service, and it is quite certain that even the company which hires such work done, will, after that, despise and distrust the man who does it for them. Breaches of trust are very rare among draftsmen. We hope they will continue to be so.

## The Locomotive Record Broken.

The New York Central's exhibition engine, No. 999, which has driving wheels 7 feet 3 inches diameter, cylinders 19″x24″, and weighs 130,000 pounds, has broken all previous records for a single mile run, by her performance on the 9th inst., when, pulling the Empire State express westward between Rochester and Buffalo, five miles were passed over in three and a half minutes, and a single mile in thirty-five seconds, which is slightly over 100 miles an hour, thirty-six seconds to the mile being the 100-mile rate.

Though it is stated that there was no intention to make a phenomenal run, it is a fact that the engine was designed to attain a speed of 100 miles an hour, and officials of the road had declared that the engine should be run at that speed.

Since writing the above the engine has still further reduced the time for a single mile by three seconds, which gives a rate of 112 5 miles per hour. At this writing (12th. inst.) it is the intention to make a run on Tuesday the 16th from New York City to Buffalo with this engine drawing two to four cars and make the distance in the shortest possible time.

The conditions as to grades, curves, quality of track, etc., on this road are very favorable for fast running, and we may naturally expect to hear of something phenomenal in that line.

On this engine there is a speed indicator and recorder which is driven from the truck wheels to eliminate slippage. This device is first adjusted properly in place by runs over measured miles, and all chances of error eliminated so far as possible, so that it is probable the speed given is at least nearly correct.

## Gambling Operations Responsible.

The recent flurry in Wall street was caused, according to all competent and unbiased authorities, by the fact that the stocks of certain large industrial enterprises had been for some time "listed" on the Stock Exchange, and had become the subject of gambling operations there, these gambling operations being, so far as any one can certainly ascertain, solely responsible for the so called "lack of confidence in the future of manufacturing operations." The Cordage Trust, whose stock led in the fluctuations, has been so organized and managed that its common stock has been recognized for some time as being almost, if not quite absolutely without intrinsic value, and entirely useless except as a basis of speculation of the character which so nearly resembles ordinary gambling as to be indistinguishable except by an expert. When this stock "broke" it was natural for the other "industrials" to be affected. These "industrials" do not by any means represent the industries of the country, but only those combinations, mostly trusts, whose stocks are regularly listed for operations in the Stock Exchange. The value of the stocks of substantial, well-managed industrial concerns outside of this influence was not affected, as was shown by the fact that banks readily accepted them as collateral security for loans, the terms of which were not unusually severe to the borrowers.

One of the most perplexing and probably the most to be regretted feature of railroad development in this country has been the fact that the stocks of our roads have been and are subject to speculative and gambling operations. To the extent that other industrial operations become involved in this speculation and gambling, they will be liable to just such troubles as some of them have been passing through.

## Literary Notes.

Brown & Sharpe Mfg. Co., Providence, R. I., have issued a sixty-four page pamphlet which is mainly devoted to things that will be of general interest to readers who propose to visit the Chicago Exposition, and scarcely less so to those who stay at home. Following a comparatively brief description of their works and tools, and an invitation to visit their shops and their exhibit at Chicago, is a brief history of Rhode Island, a chronological table giving the dates of important events in engineering and manufacture, and word views of the cities of Providence, Newport, Boston and Chicago. Then follows "Suggestions in Regard to Living and Traveling in America." This part will be of special value to visitors from foreign countries, giving as it does in brief much relating to the manners and customs of the United States. But this will not be devoid of interest to Americans who are not much accustomed to travel, and have only a limited acquaintance with hotel life. There is a cable code which was very satisfactorily used by the British and German bodies of engineers on their visit to this country in 1890. Two maps of Chicago are shown, in

which, for the sake of clearness, unimportant details are omitted, a bird's-eye view of the Exposition, etc.

We should advise every one to obtain a copy of this little book, which will doubtless pass through several editions. It will be mailed without charge to any one writing for it to the firm named at the beginning of this notice.

### Charles W. Le Count.

This well-known engineer and mechanic died at his home in South Norwalk, Conn., on May 8. He was sixty-five years old; his death resulted from injuries received by his horse running away. Mr. Le Count learned the machinist's trade with R. Hoe & Co., of this city, and afterward went to California, where, for several years, he was superintendent of the United States Assay Office. Returning East, he located in South Norwalk, and engaged in the manufacture of small machinists' tools, of which he invented a number. He was greatly interested in free education, and was school commissioner for fourteen years. He was also several times a member of the Board of Education, and was a trustee and honorary member in a fire organization. Generous hearted and charitable, always companionable, Charles W. Le Count will be missed by a large circle of friends and acquaintances.

Mr. W. E. Crane, who needs no introduction to our readers, has taken up the practice of consulting engineer, at Waterbury, Conn., and, as we should expect, is meeting with excellent success. Mr. Crane has had rare practical experience in mill and factory engineering, including the arranging and rearranging of plants for economical operation, and is well up in everything pertaining to steam engineering, to which he will give a good deal of attention. He will have the best wishes of a host of friends in his wider, but by no means, new field

## Questions and Answers.

*Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.*

(234) A. W. N., Port Smith, Ark., writes: In your answer to Query 94, in your issue of March 2, you say, "As 360 degrees is to the number of degrees in the sector," etc Now will you please give us a rule in plain mathematics for finding the number of degrees in this sector? *A.*—See answer to Question 221, in our issue of May 4, current volume.

(235) F. J. R., Buffalo, N. Y., writes: Please let me know in what issue you published the cross-sections adopted by the Franklin Institute as a standard. *A.*—The only standard system of section lining that we have published is the standard adopted at Sibley College, Cornell University, at the suggestion of Dr. R. H. Thurston. You will find this in our issue of April 9, 1887.

(236) P. G. W., San Francisco, Cal., writes: Please give me the rules for computing the compression or extension of helical springs, or refer me to some of your issues which contain these rules. *A.*—See answer to Question 262 in our issue of June 23, 1892. You will also find a valuable and reliable table of carrying capacities and deflections of helical springs, with formulas for computing the same in our issue of August 18, 1892.

(237) D , Hartford, Conn., writes: Please show how to get the answer to the following problem: Resolve into factors; $(x-y)(x^2-z^2)-(x-z)(x^2-y^2)$. *A.*—The factors of $x^2-z^2$ are $x-z$ and $x+z$; the factors of $x^2-y^2$ are $x-y$ and $x+y$; hence $(x-y)(x^2-z^2)-(x-z)(x^2-y^2) = (x-y)(x-z)(x+z)-(x-z)(x-y)(x+y) = [(x+z)-(x+y)](x-y)(x-z) = (x+z-x-y)(x-y)(x-z) = (z-y)(x-y)(x-z)$, which are the factors of the given expression.

(238) T. J. W., Binghamton, N. Y., writes: If in your answer to E. M. C., Question 214, April 27 issue, you had made the safe working tensile strength 7,000 pounds per square inch for cast-iron, how thick would the cylinder have been? *A.*—Under these conditions the thickness would have been equal to $p \times r$, which would make the thickness so great as to indicate that cast iron is not the right kind of metal to use, and that some other metal of a safe higher tensile strength must be adopted. There is a limit to the pressure in a cylinder.

(239) W. P. S., Terre Haute, Ind., writes: I would like to know if there is any possibility of making a pattern too slick and smooth for leaving the sand well. I am told that there is, and that there was an explanation of why and wherefore in your columns some months ago, but I have been unable to find it. *A*—We have never known an instance in which a pattern was too slick and smooth to draw out of the sand, and we believe that it is practically impossible to make a pattern too smooth. We are not aware that the statement to which you refer has been made in our columns.

(240) T. L. C., Palmyra, N. Y., writes: I would like to obtain a position as marine engineer, and I thought that you may be able to inform me to whom I should apply. How are young men admitted into the U. S. navy, and what are the chances of obtaining a position in the U. S. navy? *A.*—In order to obtain a position as engineer in the mercantile service you will have to procure a license, to do so you will have to appear before some local board or a supervising inspector for examination, and conform to the regulations prescribed by the Board of Supervising Inspectors; see answer to Question 61 in our issue of February 9, current volume. By the time that a license is granted you will undoubtedly know to whom to apply for a position as engineer. To obtain a position as engineer in the U. S. navy you will have to be a graduate from the naval academy at Annapolis.

(241) P. H., Scotia, Cal., writes: In speaking of the horse-power of an engine, is there any sense in saying that an engine of 25 horse-power is geared up to 50 horse power? *A.*—There is no sense in it; an engine that can steadily develop 50 horse-power is a 50 horse power engine, and if such an engine is developing 25 horse-power only, it is not doing its full duty, and it cannot be justly said that it is a 25 horse-power engine. 2. The engine in question is used for hauling logs; it is a portable engine with two cylinders 7x12 inches, with a vertical boiler carrying a pressure of 130 pounds. On the crank-shaft is a pinion driving a drum which makes one turn for every nine revolutions of the crank. How many horse-power does this engine develop running at the rate of 75 revolutions per minute, cutting off steam at $\frac{3}{4}$ stroke? I had a dispute with the man that runs it. *A.*—We should rate it at 40 horse-power.

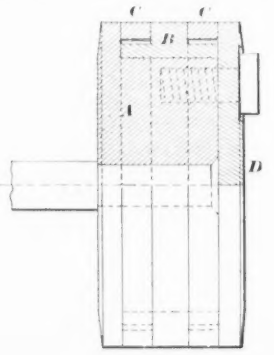
(242) P. N. H., Columbus, Ga., writes: Kindly inform me whether the diedral angle in geometry is a plane or solid angle; also why is it? *A.*—It is neither. A diedral angle is the angular space lying between two planes which meet each other. The planes are called faces of the angle, and their line of meeting is called the edge. The measure of a diedral angle is the same as that of a plane angle formed by two straight lines, one lying in each face, and both perpendicular to the edge at the same point. Diedral, like plane angles, may be either right, acute or obtuse. A solid angle is the angular space contained by more than two planes which meet at the same point, and not lying in the same plane. A plane angle is a portion of a plane lying between two straight lines meeting in a common point. The two straight lines are called the sides of the angle, and the common point the vertex.

(243) G. G., Knoxville, Tenn., asks: What diameter of pipe would be necessary to blow off steam from a 40 horse power boiler as fast as it is generated? Please give rule for computing this diameter. *A.*—The term horse-power in this case is very indefinite, and cannot be used as data from which the diameter of the escape pipe can be calculated. This diameter should be found from the grate surface. We should make the area of this pipe equal to that of a common safety valve. The United States regulations require that safety valves for ocean and river service shall have an area of not less than 1 square inch for each 2 square feet of grate surface, when the common safety valve is employed. If, for instance, the grate area is 16 square feet, then according to the above requirements, the area of the escape pipe should be $\frac{16}{2} = 8$ square inches; the corresponding diameter is $3\frac{1}{4}$ inches nearly.

(244) A. L. G., Providence, R. I., writes: In turning disks of cast-steel 8 inches diameter and 4 inches wide, without a compound rest, using a tool that turns the whole face at one cut, how much force in pounds at the circumference of the work will it take to remove the stock in the form of light scraping chips? Also give speed to be used with plenty of oil to obtain the best results. If there is no way of computing it, please give estimate. *A.*—Much depends on the quality of the material in the disk, cutting speed, and the depth of the cut; it is impossible to make computation with any degree of accuracy. We should estimate that the pressure on tool when the cut is .01 inch deep, and a cutting speed of 10 feet per minute, will be 9,900 pounds. 2. The driving shaft makes 150 revolutions per minute; size of smallest step on cone is 8 inches, what should be the size of gears, diameter, pitch and face of teeth, the number of steps on cone and their diameters, all to be of sufficient strength to do the work? *A.*—You can obtain all these dimensions from a well-constructed engine lathe, on which a $3\frac{1}{2}$-inch belt is used. 3. Supposing the straight line forming the top of tool to be on a level with and pointing directly towards the center of the work, in what direction from the cutting point of tool will the force act? *A.*—Practically perpendicular to the face of the tool.

(245) B., Port Huron, Mich., writes: A certain manufacturing concern, well known to us, ordered of a zinc manufacturer two or three hundred pieces of No. 26 zinc cut to size. The concern wanting the zinc supposed that zinc, sheet-iron and other similar metals all came under the one gauge. On arrival of the zinc ordered, they found that instead of No. 26 wire gauge that it was $\frac{3}{8}$ inch thick. The zinc company was notified of the error, and claimed that a special gauge was used for zinc and that No. 9 zinc gauge was the same as No. 26 wire gauge. Kindly state whether there is a recognized standard zinc gauge? *A.*—There are gauges for nearly all purposes, and no gauge in particular can be called a standard. It is generally stated that the Birmingham wire gauge is for iron and steel only, but we believe it is used by some for zinc, copper, brass and lead. There is another Birmingham gauge for sheet brass, gold, silver and other metals, but what these metals are cannot be determined. There are also special gauges for zinc but they do not agree. There is an American gauge, wire gauges all differing from each other, and various firms have gauges of their own. The whole system is an extremely senseless one and serves only to create confusion. The system should be ignored, and in giving an order the thickness should be stated in inches, or if preferred, the weight per square foot, when plates are ordered; or the weight per hundred feet of wire when the latter is ordered.

(246) H. G. R., New York, writes: I am building a four-cylinder engine, marine type. I have been advised to use cast-iron rings for my pistons. How much smaller shall I turn the piston than the bore of the cylinder? The diameters of the bore of cylinders are $3\frac{1}{2}$, $5\frac{1}{4}$, $8\frac{1}{2}$ and $12\frac{1}{2}$ inches. *A*—For pistons so small in diameter it will be difficult to spring the packing rings into their grooves in a solid piston without the




liability of breaking them. We should therefore prefer the pistons made in three parts, the piston head *A*, the T-ring *B*, and the follower *D*. These should be turned about $\frac{1}{64}$ inch less in diameter than the bore of the cylinder, but this reduction in diameter should not exceed $\frac{1}{64}$ inch, the piston should have simply an easy fit in the bore. 2. How much larger than the diameter of the bore shall I turn the packing rings, and how thick should they be to give the best satisfaction? Piston speed will be about 300 feet per minute, boiler pressure 225 pounds. *A.*—The thickness of rings for the $3\frac{1}{2}$ inch cylinder should be $\frac{8}{16}$ inch, width $\frac{5}{16}$ inch; for the $5\frac{1}{4}$-inch cylinder $\frac{5}{16}$ thick and $\frac{7}{16}$ inch wide; for the $8\frac{1}{2}$" cylinder $\frac{7}{16}$ inch thick, $\frac{9}{16}$ wide; and for the $12\frac{1}{2}$ cylinder $\frac{9}{16}$ inch thick and $\frac{1}{2}$ inch wide. For the smaller cylinders the rings should be turned $\frac{5}{32}$ inch larger in diameter than the bore, and for the larger ones about $\frac{1}{8}$ inch larger than the bore. These rings should be split diagonally and a sufficient amount of metal taken out to prevent their ends from touching each other when they become hot in the cylinder. Should solid pistons be preferred the thickness of packing rings may have to be somewhat reduced so as to spring them in the grooves without running too great a risk of breaking them.


## Business Specials

*Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.*

Grant's gears, Lex'n, Mass., & Phila., Pa. See p. 11.

Shafting Straighteners J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N.Y.

Forming Lathes Mer. Mach. Tool Co., Meriden, Ct.

Air Hoists, Frank Richards, Box 3686, N. Y.

Milling Machs. Kempsmith M. T Co., Mil., Wis.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Pattern and Brand Letters. A variety of sizes and styles Heber Wells, 8 Spruce St. New York.

Drill Presses, with Tapping Attachments.
Gould & Eberhardt, Newark, N. J.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St , N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O

Engine Castings, Humphrey's Foundry, Bellefontaine, O.

For Cypress Tanks and Vats, address W. E. Caldwell Co., Floyd and Main Streets, Louisville, Ky.

"Pumping Machinery." New book, 450 pp, 8vo, 270 Eng. Prospectus free. W. M. Barr, 3223 Powelton Avenue, Philadelphia, Pa.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt, Newark, N. J.

For the Latest Improved Diamond Prospecting Drill address the M. C. Bullock Mfg. Co., corner Canal and Washington Sts., Chicago, Ill.

Combination, duplex and special gear cutters in stock and to order, vertical milling machines. R. M. Clough, Tolland, Conn.

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears.
Gould & Eberhardt, Newark, N. J.

Builders Iron Foundry, Providence, R. I., Mortar Mounting, and 2 – 12" B. L. Rifled Mortars in front Govt Bldg., Chicago Pamphlets on application.

Passaic Art Casting Co., 35 Warren St., N. Y. Finest Castings in the world. Brass, German Silver, Aluminum, etc. Patent Pressure Process. Machinery Name Plates.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
111 Broadway, New York.
Send for Brief History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles the "Common Sense," as heretofore sold by us and mailed to any address at $1 00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO , 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.


### Philadelphia Shop Notes—I.

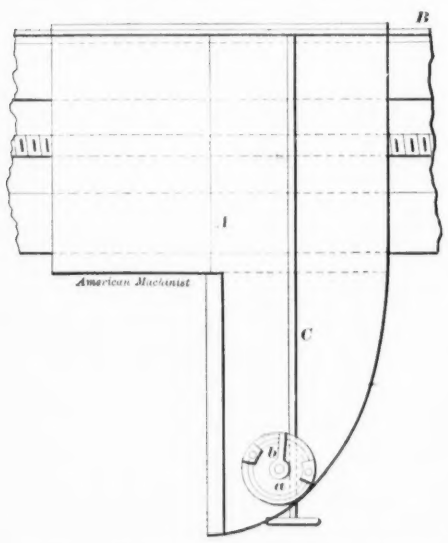
The character of the business done by Pedrick & Ayer has undergone a decided change since the erection of their new shops a few years ago, this change in character, together with the growth of their business, having already rendered their new shop somewhat small for their needs, and somewhat illy adapted as well. When it was constructed, a large proportion of their business was in smaller appliances and various attachments to regular machine tools—a class of work to which the relatively narrow and high building was well adapted. Though there has been no diminution of this department of their business, but perhaps a growth instead, the development of their business in milling machines and in the Richards side planer has been so rapid that this relatively heavier work now predominates, and the tendency seems to be toward still heavier work, so that a shop covering more ground, having fewer flights of stairs and better opportunity for the employment of power cranes, would seem to be one of the coming requirements. The general movement toward heavier and larger tools, which very few tool builders have been able to resist, even if they wanted to do so, has affected the

RICHARDS SIDE PLANER,

and it has now gone far above the limits which it was at first supposed it would reach, and the business of fixing limits to its size has been entirely abandoned, the

largest so far constructed, however, being to plane 42″ wide and 12 feet long, the machine weighing 40,000 pounds—much less it is true than the weight of a modern planer to plane work of the same size, but, nevertheless, the machine is built upon exceptionally heavy proportions, and with bearing surfaces of the saddles upon the bed and arm that are well calculated to inspire confidence in the machine. The comparatively light weight results, of course, from the fact that the tool and the arm that carries it over the work are the only things moved, the work remaining stationary, and it may be as big as can be got into the shop, or that can be sunk in a pit in front of the machine. A greatly increased driving power has accompanied the increase in size, and some very heavy cuts are taken on armor plate and similar work, to which the machine is peculiarly adapted. At the same time the smallest size becomes a very convenient little shaper, and will plane 12″x30″ upon work of any size which can be got up to it.

Of course a man can reach all over this small machine, and shift the belts for stopping or reversing, by taking hold of the shifting bar which passes along the bed over the saddle, and is moved by the saddle at the ends of the stroke, collars being set on the bar for an arm fixed to the saddle to strike against, and thus shift the belts. On the large machines this cannot be done in that manner, because the operator cannot reach over the machine to the shifting bar, and the difficulty has been the incentive to the invention of a very ingenious device—understandable by reference to the accompanying sketch (not drawn to scale) which is a plan view of a portion of the bed with the saddle *A*, which is moved by the screw as




shown. At the back and over the saddle is the shifting bar *B*, which is rectangular in section, and has its lower edge cut with rack teeth the entire length. Engaging with this rack is a pinion, which is on the end of the shaft *C*, this shaft then passing to the front of the arm, where it is provided with a hand-wheel as indicated. It is now apparent that if the shaft *C* meets with no resistance it will be revolved within its bearings as the saddle moves along the bed without moving the rack; but this shaft may meet with resistance in two ways, and if its rotary motion be arrested entirely, it will cause the rack or shifting bar to move with the saddle, and the minimum length of stroke of the latter will be obtained. Near the front of the arm is a disk *a*, which is stationary, and has on its upper face a T-slot, to which two dogs are fitted, and can be clamped at any point in its circumference. Passing up through the center of the disk is a shaft which at the top carries the swinging arm *b*, the lower portion of this shaft carrying a worm-wheel, which is driven by a worm on the shaft *C*. The proportions of this worm-wheel are such that it makes something less than one revolution when the saddle moves from one end of the bed to the other; but when the swinging arm *b* meets one of the dogs, its motion, and consequently that of the shaft *C*, are arrested, and the rack *B* is moved to shift the belts and reverse the motion of the saddle. The arm *b* can be raised to clear the dogs when desired, so that the saddle can be run to any desired point, and controlled by hand without disturbing the position of the dogs, safety stops being provided at each end of the extreme stroke.

A SECTION SLATE.

In the drafting room of Pedrick & Ayer is an application of the principle of the squared or section paper, which seems to be a very good one. It consists of a slab of slate, 6x5 feet, which is fastened to the side wall, and has cut upon its surface squares of an inch, enabling chalk sketches to be readily drawn full size, or to a large scale. The squares were laid off, however, in this case by the man who furnished the slab, and who, being told to make them one inch each way, measured each one successively from the preceding one, instead of laying his scale upon the slab, and marking all the lines from it without moving it. And his inch being somewhat large, the error accumulated, and became greater than a draftsman or machinist likes to allow. The incident illustrates the importance of the machinist knowing what other people's conception of the inch or of measurements generally may be, his conception of these things being somewhat different from that of most other mechanics. F. J. M.

## MANUFACTURES.

The Gadsden (Ala.) Pipe Works will double their capacity.

The Pekin (Ill.) Boiler Works have doubled their capacity.

The Malleable Iron Co., of Dayton, O., is erecting an addition.

The United States Bronze Co., of Cleveland, O., has been incorporated.

The Diamond Brass Foundry has been formed in Chicago, by Edward MacSteen.

A company has been chartered to establish engine works at Knoxville, Tenn.

The Mark Flather Foundry Company will erect a new foundry at Nashua, N. H.

The Milwaukee (Wis.) Boiler Company will erect large boiler works to cost $165,000.

The Suda Hardware Manufacturing Company has formed at Louisiana, Mo. Capital $10,000.

The Standard Scale and Supply Company is building additions to its factory in Bellefonte, Pa.

The Lexington, (S. C.) Manufacturing Company will erect a batting-mill in addition to its present plant.

The Spaulding Brothers Co., of Townsend, Mass., has been formed, with capital of $30,000, to make leather board.

The Wrought iron Range Company, of St. Louis, Mo., have filed articles to increase their capital stock from $500,000 to $1,000,000.

The Wausau (Wis.) Wagon Supply and Tool Company has organized, with a capital stock of $100,000, to erect and operate a factory.

The Aroostook Novelty Company has been chartered at Houlton, Me. The officers are W. A. Nickerson, president; J Archibald, treasurer.

The National Hosiery Company has been incorporated at Cohoes, N. Y. The capital stock is $250,000. and F. Beiermeister, Jr., is the principal holder.

Schaeffer & Budenberg, 83 John street, New York, issue a circular illustrating and describing the Thompson indicator as made at their works. Prices of indicator and appliances are given.

The G. G. Page Box Company, of Cambridgeport, Mass., is to establish a shook-mill at Buckston, Me. The new mill will be 60x150 feet, one story high, and when running at full capacity will employ 50 hands.

The C. A. Edgarton Mfg. Co., which is now located in Shirley, Mass., has decided to move to Fitchburg, Mass. A three-story brick building 225x46 feet, standard mill design, will be erected for the new concern.

The Educational Toy Company has been organized at Hartford, Conn., with capital $10,000, to manufacture toys, etc. The officers are president, Dr. M. M. Johnson; treasurer, H. W. Fox, and secretary, H. H. Kellogg.

The Whitewater Wagon Company, of Whitewater, Wis., has been organized, with a capital stock of $75,000. The new concern has secured the Winchester & Partridge plant at that place. They expect to have fifty men at work by June 1.

A coal company has been organized at Galesburg, Ill., with a capital of $1,000,000, to build a railroad from Wataga, Ill., to Victoria, Ill., and to operate a large coal shaft south of the latter place, giving employment to 800 or 1,000 miners.

The Lehigh Steel and Iron Company, of Allentown, Pa., was granted a charter recently. The capital is $250,000, divided into 5,000 shares at the par value of $50 per share. The directors are William H. Ainey, Martin Kemmerer, Edward M. Young, and others.

The Williams Manufacturing Company was recently organized at Portland, Me., with William L. Freeze as president and H. L. Williams treasurer and general manager. The company will carry on a general wood working business and have established a lumber yard and planing-mill on Kennebec street.

Bridgton, Me., citizens are subscribing liberally to the building fund for a new tannery to take the place of the one recently destroyed by fire. Success is practically assured. The new tannery will be spacious, and will be thoroughly equipped with machinery to enable the management to conduct an extensive business.

Crane & Co. are to erect a large paper-mill at Dalton, Mass. The mill, which is to be of brick, will be 271x209 feet, three stories. The mill will be equipped with six rag engines and two paper machines, capable of producing an output of two tons of finished paper a day, and it is hoped to start the works November 1.

A stock company has been organized for the purpose of building a cotton factory at Settlemyer's Mill, in Cleveland County, N. C. A $40,000 plant is proposed, and subscriptions for over half this amount have already been secured. Mr. Miller is president; Mr. Beam, vice-president, and Mr. Wilkins, secretary and treasurer.

A mill for making staves, heads and hoops for sugar barrels is to be started in Angelica, N. Y., by F. E. Church, of Morris Run, Pa. This plant will consist of several buildings, dry kilns, etc., and will employ from 20 to 25 hands at the start. The location of this industry at this place is on account of cheap timber, good shipping facilities, and low freight rates.

The Berlin Iron Bridge Co., East Berlin, Conn., has issued a large 317-page catalogue containing engravings—both exterior and interior views—of a great number of shops, factories, and other iron buildings which they have constructed. There are also engravings of several bridges. The catalogue is well printed on good paper, and is a most interesting and instructive one.

There is water-works agitation at St. Louis, Mo.; Woodbury, N. Y.; Millbury, Mass.; Atlanta, Ga.; Rock Valley, Ia; Lebanon, Pa.; Cambridge, O.; North Brookfield, Mass.; Easthampton, Mass.; Philadelphia, Pa.; Redlands, Cal; Birmingham, Ala.; Tiffin, Ohio; Henrietta, Tex.; Winside, Neb.; Pitkin, Cal.; Plain City, O.; Irvington, N. J.; Jersey City, N. J.; Lowville, N. Y; Holyoke, Mass.

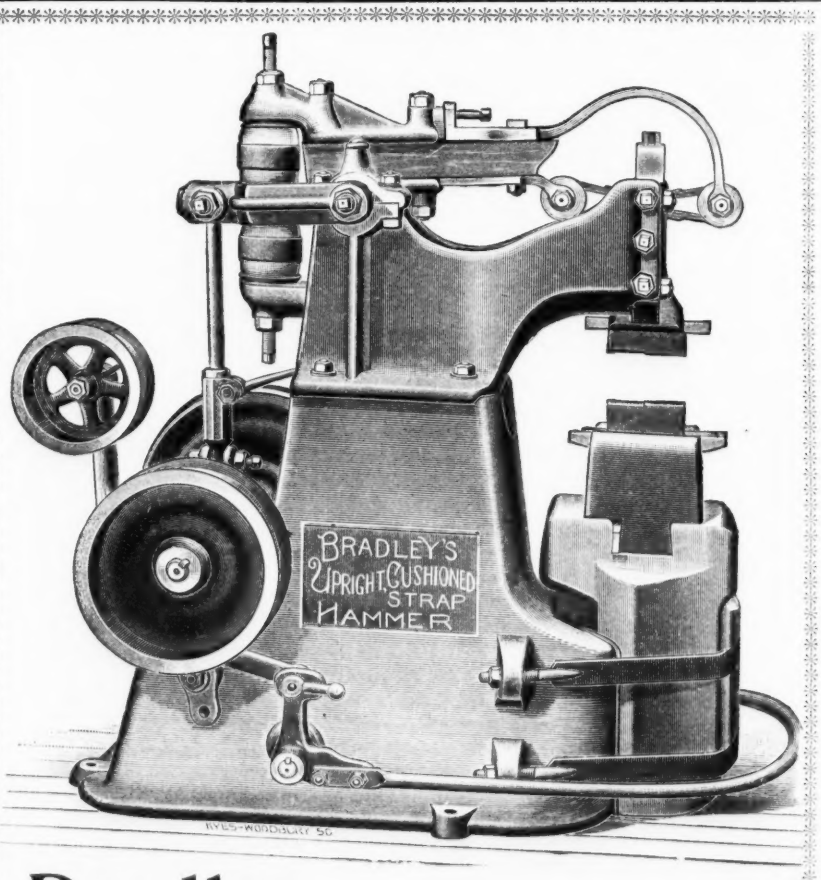
The Livingstone Manufacturing Company has recently been incorporated in Rockland, Me., with a capital of $9,000, for the purpose of manufacturing granite and marble tools. A factory building is to be erected at the south end. C. W. Livingstone being superintendent and G. H. Blethen, business manager. The company have the contract to make the bush hammers and other granite tools invented by O P. Howard, of Rockland.

A large brewery is to be erected in Ayer, Mass. The president of the company is Mr. Joyce, of the firm of Joyce & Curran, of Lawrence. It will be quite an extensive establishment. This fact will perhaps be better realized when it is stated that the company has a capital stock of $300,000, and that $250 000 of this sum will be expended on the buildings. The plant will have a capacity of 75,000 to 100,000 barrels a year to begin with.

A new pulp mill is to be established at Veazie, Me., by the Penobscot Pulp and Paper Co., which was organized recently with capital $100,000. A portion of a factory already erected will be utilized, and a two-machine equipment will be put in with capacity of about seven tons pulp daily. The new company will lease wheel pits and water power of the Public Works Co., and will put in two more water wheels of 200 horse power each.

T. R. Almond, Brooklyn, N. Y., gets excellent returns from his coupling, which is designed to couple shafts at any angle, doing away with the use of belts or gears. One of these couplings has been in constant use in a manufacturing establishment in Brooklyn since 1885, connecting two shafts at right angles, and we are informed over the signature of the proprietors of the works, Somers Bros., that it has never in any way given them the least trouble.

The Katahdin Pulp and Paper Company was organized in Portland, Me., recently, with a capital stock of $200,000, all paid in, and these officers: President, Thomas W. Draper, of Boston; treasurer, George E. Keith, Boston; directors, Thomas W. Draper, George E. Keith and Charles E. Curtis, of Boston; N. M Jones, of Bangor, and J. B. Mullen, of Old Town. The company has acquired the pulp-mill plant at Lincoln, which has been idle for several years, will re-construct it into a sulphite pulp-mill, and operate it with a daily output of 15 tons.




# Bradley Hammers.

If you plate, draw, square, taper or weld iron and steel, you need a Bradley Hammer.

If you swage, collar, spindle, or do any manner of die work, a Bradley Hammer will soon pay for itself.

That the Bradley is the best Power Hammer in the market has never been questioned. Our circulars illustrate, describe, give sizes and prices.

BRANCHES: 114 Warren St., New York. 196-98 Sudbury St., Boston.

BRADLEY & COMPANY, Syracuse, N. Y.

The St. Louis (Mo.) Radiator Manufacturing Company is the name of a new concern, of which Messrs. Daniel, E. W., O. and C. K. Garrison are the incorporators. The capital of the company is $50,000. The company have leased a part of the old South St. Louis foundry, have got their plant in readiness, and expect to begin work in a few days. They will manufacture a first class radiator under the Holland patent, and will push the business vigorously at home and abroad.

J. A. Fay & Co., Cincinnati, Ohio, are receiving many commendatory letters regarding their new and elegant catalogue which we noticed in our issue of April 13. The following letter, from W. H Lewis, master mechanic of the Chicago, Burlington & Northern Railroad, is a sample, and is interesting as confirming the opinion that when issuing a catalogue it pays to make it a good one. Mr. Lewis writes: "Your new catalogue received, for which please accept my thanks. It is certainly a 'beauty,' and a work of art, and is evidence of a prudent management, as it presents your business in a form that will be valued and preserved, in place of spending large amounts for cheap circulars, etc., that are not in form for ready reference, and are soon consigned to the waste-basket."

The Nitro-Alkaline Fibre Company, with a capital of $500,000, was organized in Portland, Maine, recently, to manufacture all kinds of wood, straw and other vegetable pulp; to construct and operate pulp-mills, and to license other persons and corporations to use the new process. The process is covered by letters patent granted Mrs. Helen L. Palmer and Adna T. Dennison by the United States, Canada, Norway, Sweden, Germany, France Austria and Belgium. Previous to the development of this process, all chemists declared that nitric acid could not be used successfully in the manufacture of wood pulp, but by its use in combination with caustic soda, pulp superior to the best soda pulp has been made under this process, at a marvelous saving in time and expense. The president of the company is Charles W. Richardson; vice-president, Adna T. Dennison; treasurer, Harry R. Virgin; directors, C. W. Richardson, Adna T. Dennison and Helen L. Palmer.

## Machinists' Supplies and Iron.

NEW YORK, May 13, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.50 to $15.25; No. 2, $13.50 to $14.25; Gray Forge, $12.25 to $12.50. Southern brands of good quality are obtainable at $14.25 to $14.50 for No. 1 Foundry; $13 to $14 for No. 2 and $12 to $13 for Gray Forge.

Antimony—The market is steady. We quote L. X., 10¼c. to 10⅝c.; Cookson's, 10½c. to 10¾c.; Hallett's, 9.90c. to 10c., and U. S. French Star, 10½c.

Copper—The market is rather weak, and buyers do not seem to be inclined to give 11c. for Lake Copper, which is the outside figure asked. Casting Copper is held at 10⅛c. to 10¼c.

Lead—There has been a decline in price, and business might be done at 3.75c. Buyers are holding off, as they expect to see lower rates, but this is somewhat doubtful.

Lard Oil—Prime City is quoted at 87c. to 88c.

Spelter—The market is dull, and lower prices prevail; 4.35c. is asked.

Tin—There has been a decline in price due to liquidation and heavy arrivals. The quotations are 20.05c. for spot, 20.10c. for June, and 20.30c. for July, with sales of June at 20.10c. to 20.15c., and August at 20.50c.

## ✻WANTED✻

*"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.*

Wanted—Foremanship; engines, pumps or general jobbing. Indicator, AMERICAN MACHINIST.

Wanted—1st-class mach. shop foreman. Give age, salary expected, and refs. M., AM. MACHINIST.

Wanted—Six 1st-class machinists. Apply Toledo, Ann Arbor & Nth. Mich. Ry., Owosso, Mich.

Draftsman wishes position on machinery in general. F. F. Kirpal, 128 W. 61st street, N. Y.

Wanted—Draftsman in Philadelphia; give experience. Address Box 121, AMERICAN MACHINIST.

A mech. draftsman wants a position; makes neat, accurate drawings. Address W. S. S., AM. MACH.

Mech. draftsman, with several years' experience, desires position. Address Box 123, AM. MACHINIST.

Draftsman and designer wants a position in steam, ice, or hoisting machinery. Box 124, AM. MACH.

Draftsman (designer), mach. tools, jigs, fixtures, general mach'y, desires pos. H. M., AM. MACH.

Wanted—Position as draftsman. Have had tech. education, 3 years' machine shop practice, and 2½ years as draftsman; age, 24. W. L. S., AM. MACH.

Mech. draftsman, good designer, shop practice, exp. in power transmission and gen. mach'y, wants position as draftsman or eng. Box 38, AM. MACH.

Wanted—Wood pattern makers, accustomed to eng. & mach. work; must be accurate. State exp. and wages. Hogan Boiler Co., Middletown, N. Y.

Wanted—A 1st-class foreman for machine shop. One experienced in saw-mill work. The McArdle & Sinclair Mfg. Co., New Orleans, La.

Wanted—Six planer, ten lathe and ten vise hands; must be thorough practical machinists. S. K. White, 75 North Clinton street, Chicago, Ill.

(*Continued on page 12.*)

**Ready Made Cut Gears.**
**Ready Made Cast Gears.**
**Ready Made Brass Gears.**
**Gears Made to Order.**
**Gear Cutting.**
**Gear Book, 15 cents.**
**Treatise on Gears, $1.00.**
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**GEORGE B. GRANT,**
**Lexington, Mass.,**
**and 125 South 11th St.,**
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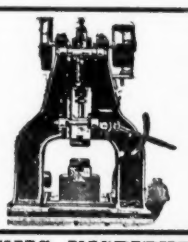

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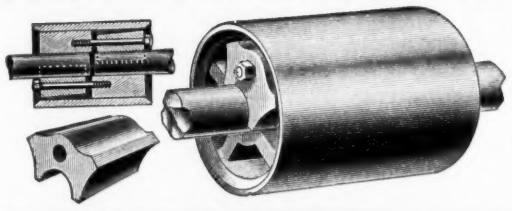

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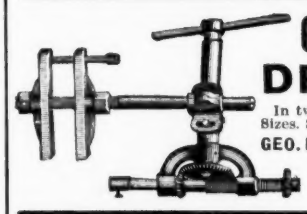

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contemplating the expenditure of a large amount in the establishment of a manufacturing industry, requiring the use of a thoroughly equipped Machine shop, Boiler shop, Foundry and Smith shop plant, well located on competing trunk lines of railroads and in a good labor market, is invited to address, **STIMSON, WILLIAMS & CO.,** Bryant Building, 55 Liberty St., New York.

**The Manufactory of Precise Measuring Instruments of Aug. Kirsch & Co.,**
**At DAMM ASCHAFFENBURG, (Bavaria),**
wants for the sale of their manufactures for the construction of machines a connection with wholesale houses and dealers in tools. Best, most exact execution of orders at reasonable price.

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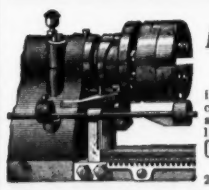
**Made in all Sizes to Cut from 1-4" to 6".**



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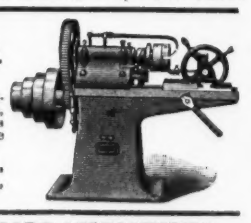

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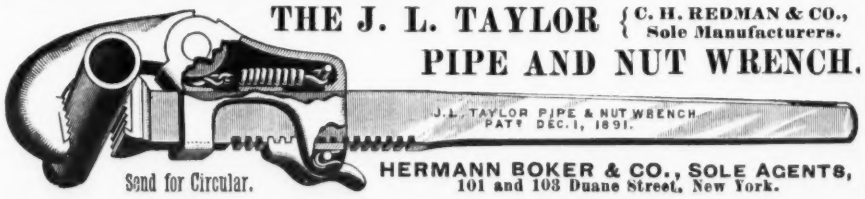


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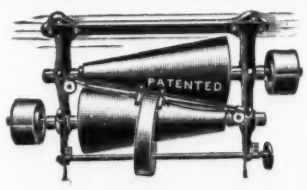


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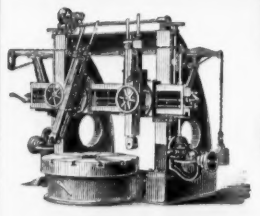

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The Mason Pump Governor is to the direct acting steam pump what the ordinary ball governor is to the steam engine. It attaches directly to the piston rod of the pump and operates a balanced valve placed in the steam pipe, thereby exactly weighing the amount of steam to the needs of the pump, and economizing the same. By using the Mason Governor, you can instantly set or change your pump to any required speed, which will be maintained in spite of variation in load or steam pressure. As all the working parts of the governor are immersed in oil, the wear is reduced to a minimum. It is largely used on vacuum pumps, deep well pumps, water works pumps, ice machines, and all classes of pumps requiring an uniform strike.

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**THE STANDARD**

## ✻WANTED✻

*"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.*

Wanted—Position as foreman by man well up on tool and jig work and piece-work system. Address Ohio, care AMERICAN MACHINIST.

Young draftsman, with technical education wants position in New York City, or vicinity. A1 references. Address Box 118, AM. MACHINIST.

Wanted—Position as foreman in iron foundry; experience twenty years; age 40; holding similar position in a first-class jobbing shop at present; references furnished. Address Box 104, AM. MACH

Wanted—Pos. as manager or superintendent by a hustler, capable of handling men and business, who wishes to change from present position and locality. Address Hustle, Box 112, AM. MACH.

Young man, technical graduate, 12 years' shop and drawing-room experience, wants position in charge of drawing-room, or as ass't on steam eng. and general mach. Refs. Box 122, AM. MACH.

City or country. Expert helpers furnished without charge, for carpenters, wood carvers, and wood turners. Small pay acceptable at start. Address 225 E. 9th street, New York City.

Wanted—A young man with exp in mech. drawing, to work under instructions of mech. eng., as ass't draftsman. Address, giving ref., and stating exp., and salary expected, Box 119, AM. MACH.

Wanted—1st-class vise and floor hands of large experience; must be sober and industrious. Can secure steady employment. Married men preferred. Morgan Engineering Co., Alliance, Ohio.

Wanted—Position as chief draftsman, by a mech. draftsmar, who has had 10 years' practical exp. on hydraulic machinery, Corliss and triple expansion engines and special mach'y. Box 114, AM. MACH.

Mech. eng. wants pos. as supt.; has tech. education, and 30 yrs' exp. as apprentice, journeyman, draftsman, foreman, chief eng., assist. supt., and general supt. Good refs. Box 120, AM. MACHINIST.

Wanted—Foreman machinist and foreman boiler maker. A steady pos. is open for 1st-class foreman mach & foreman boiler maker; young married men pref'd. Address for application, giving ref., exp., last place, & pay expected, to Box 117, AM. MACH.

Machine shop foreman desires to change. Experience covers shafting and general machinery, new and repair work around rolling-mills, including care of and repairs to engines from 10 to 1,500 horse-power. Box 108, AMERICAN MACHINIST.

## ✢ MISCELLANEOUS WANTS ✢

*Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.*

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Screw-cutting lathes, 26″, 28″, 30″ swing, $375 each; other large tools cheap. 229, AM. MACH.

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The entire outfit of two well equipped Machine Shops, which we have just purchased. The lot comprises:

**DRILL PRESSES,**
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**PLANERS, SHAPERS,**
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**SCREW MACHINES,**
**TAPPING AND CENTERING MACHINES,**
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**GEAR CUTTERS,**
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**GRINDSTONES,**
**FORCES AND ANVILS.**

All can be seen in our warerooms. Write for photographs, description and prices of tools wanted.

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| " | 44 in.x16 ft. | " | 24 in.x5&6 ft. |
| " | 36 in x12 ft. | | 24 in.x4 ft. |
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80 in.x18 ft. Engine Lathe Geared Face Plate.
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52 in.x35 ft. Engine Lathe Horizontal Boring Machine, one end.
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33 in.x27 ft. " "
32 in.x12, 14, 16, 18 ft. Bed. New Engine Lathe.
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25 in.x12, 16, 20 and 24 ft. Bed. New do do
21 in.x10, 12 ft. Bed. do do do
20 in.x 5, 6, 8 & 12 ft. do 2d Hand do do
18 in.x 6, 7 & 8 ft. do New & do do do
17 in.x 8 ft. do do do do
16 in.x 6 & 8 ft. do do do do do
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Car Axle Lathe, Bement. | Driving Wheel Lathe 88 in.
15, 16, 18, 25 in. Crank Shapers. | Wheel Quartering Mach.,
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| 18 in.x 8 ft., do | Horton. Improved style. | | |
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| 21 in.x10 ft., do | do do do | | Perkins |
| 22 in.x10–12 ft., do | Improved style. Ex. heavy. | | |
| 24 in.x12–14 ft., do | do do | | |
| 28 in.x16 ft., do | do do | | |
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### PLANERS.

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| 21 in.x 5 ft., complete. | Fair order. Cheap. | |
| 24 in.x 5 ft., do | Good order. do | |
| 24 in.x 6 ft., do | do | Lathe & Morse |
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| 14 in. do | do | do | Improved. | Fitchburg |
| 15 in. do | do | "New Improved Style." | | |
| 20 in. do | do | Ex. heavy. | Good order. | |
| 22–26 in. do | Triple Geared. | Improved. | | |

### MISCELLANEOUS.

Upright Boring and Turning Mill 38 in. A1.
Brown & Sharpe Vertical Turret Machine A1.
Slotting Machine 8 in. Modern style A1.
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Screw and Milling Machines, Bolt Cutters, Presses, Punches and Shears, Grinders etc.

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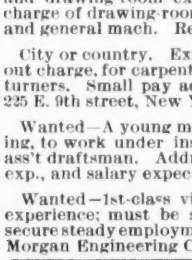
Mechanical and Electrical. Contractors for the manufacture of specialties, or can furnish complete plants for their manufacture. Make Dies, Special Tools, Gauges, Drawings, Patterns, Models. Inventions perfected. Estimates furnished. Correspondence solicited.

Send for Circular of our SENSITIVE KNEE DRILL.
**BRADY M'F'G. CO.** 83 Washington St., BROOKLYN, N. Y.



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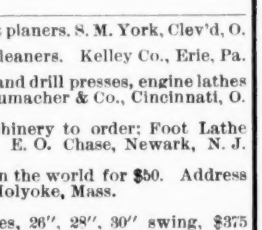

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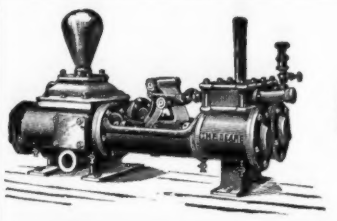

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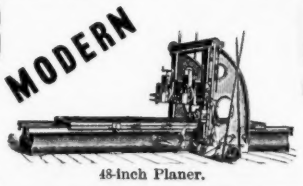
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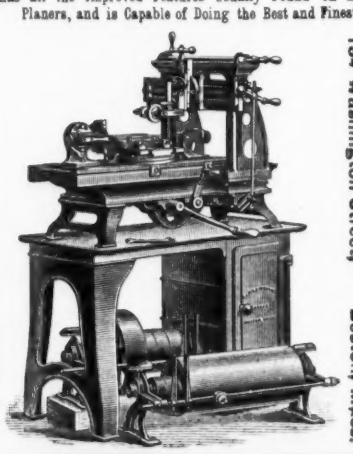

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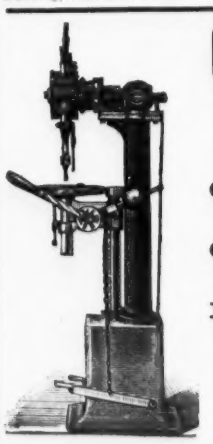

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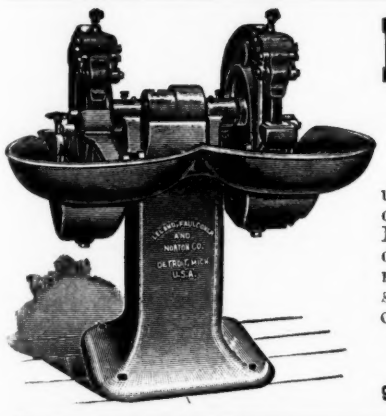

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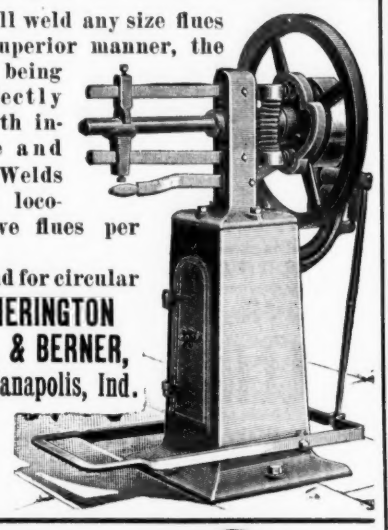

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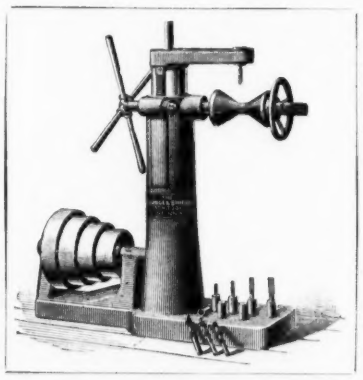

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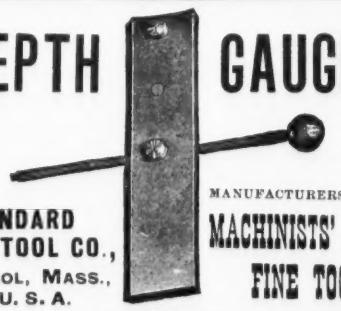

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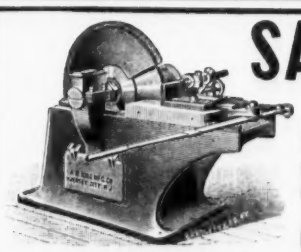

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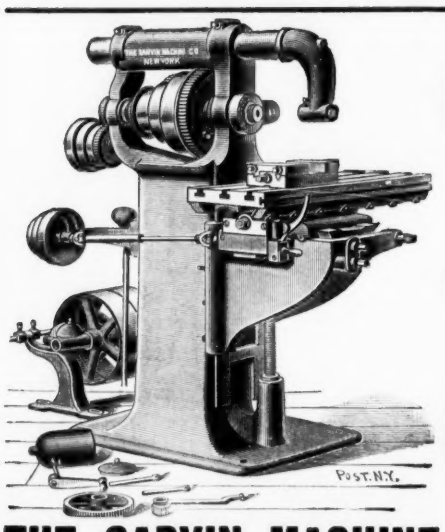

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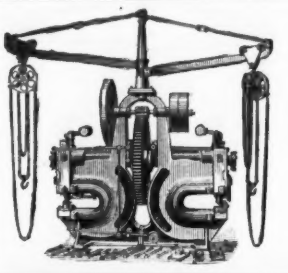

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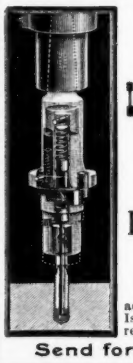

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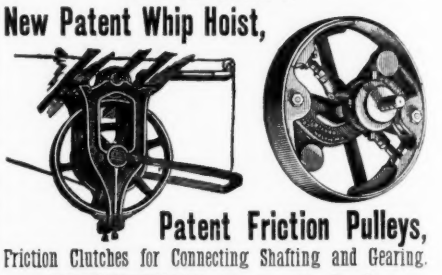

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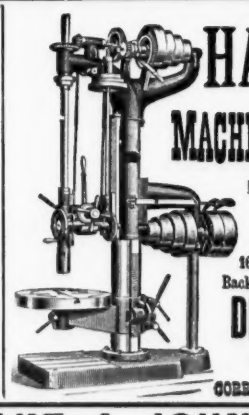

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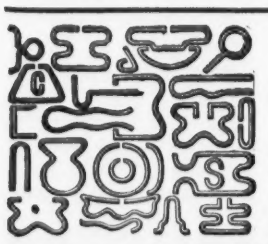

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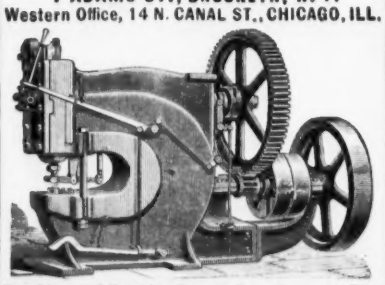

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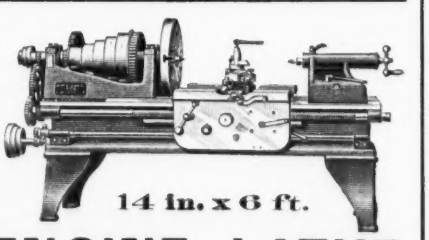

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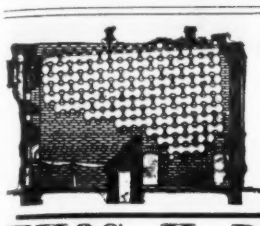

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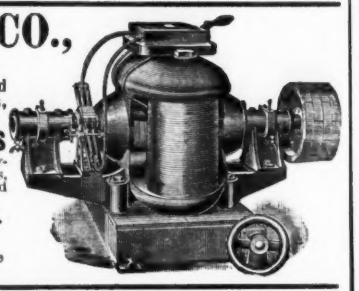

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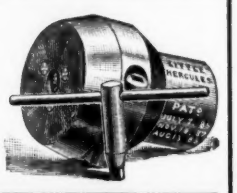

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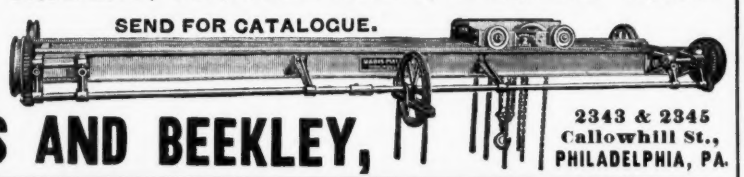

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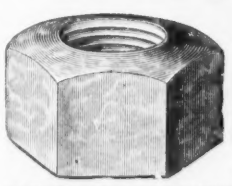

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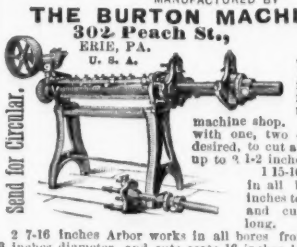

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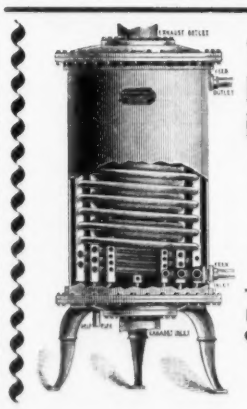

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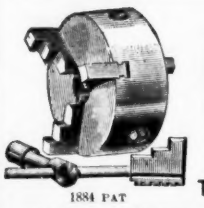

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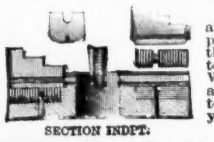

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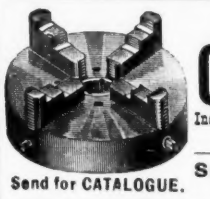

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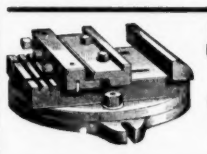

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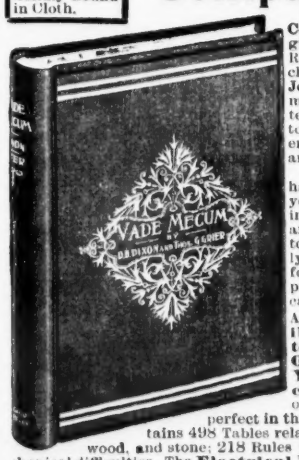


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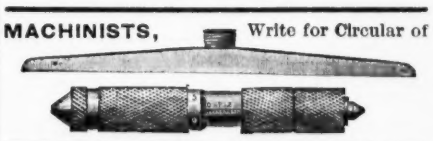

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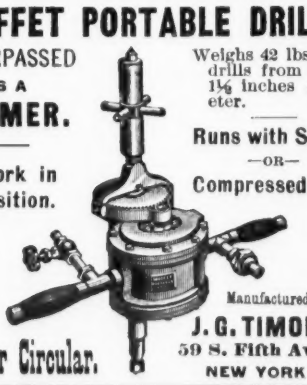

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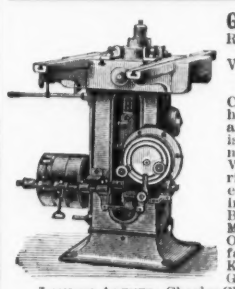

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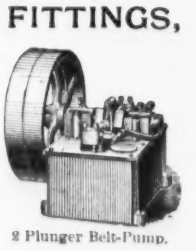

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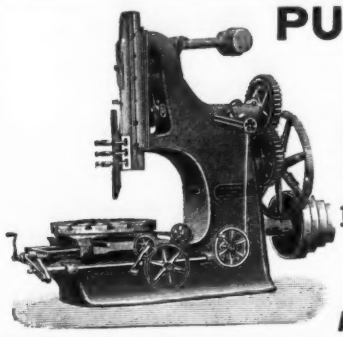

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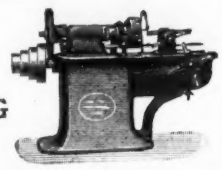

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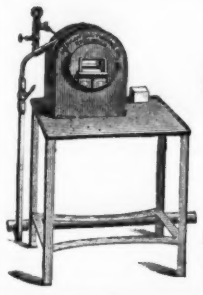

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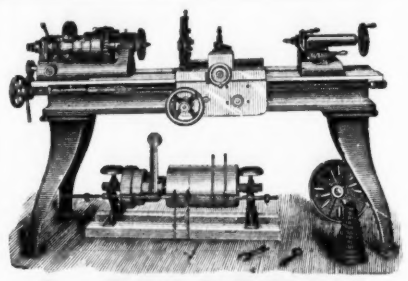

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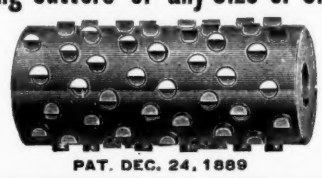

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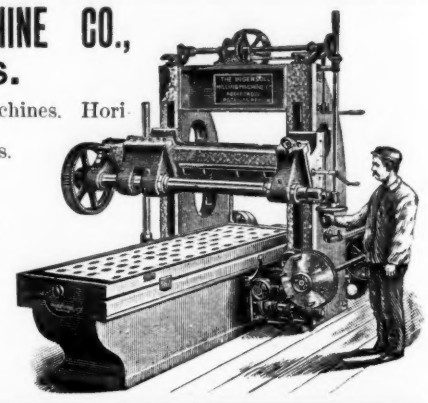

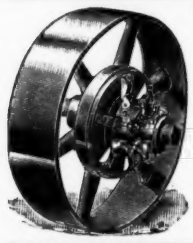

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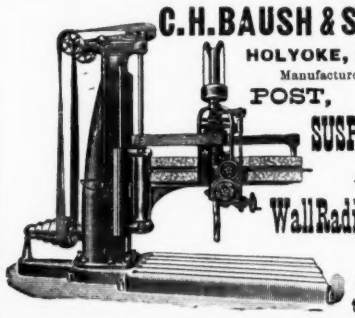

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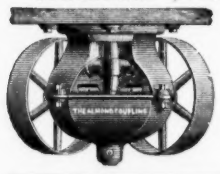

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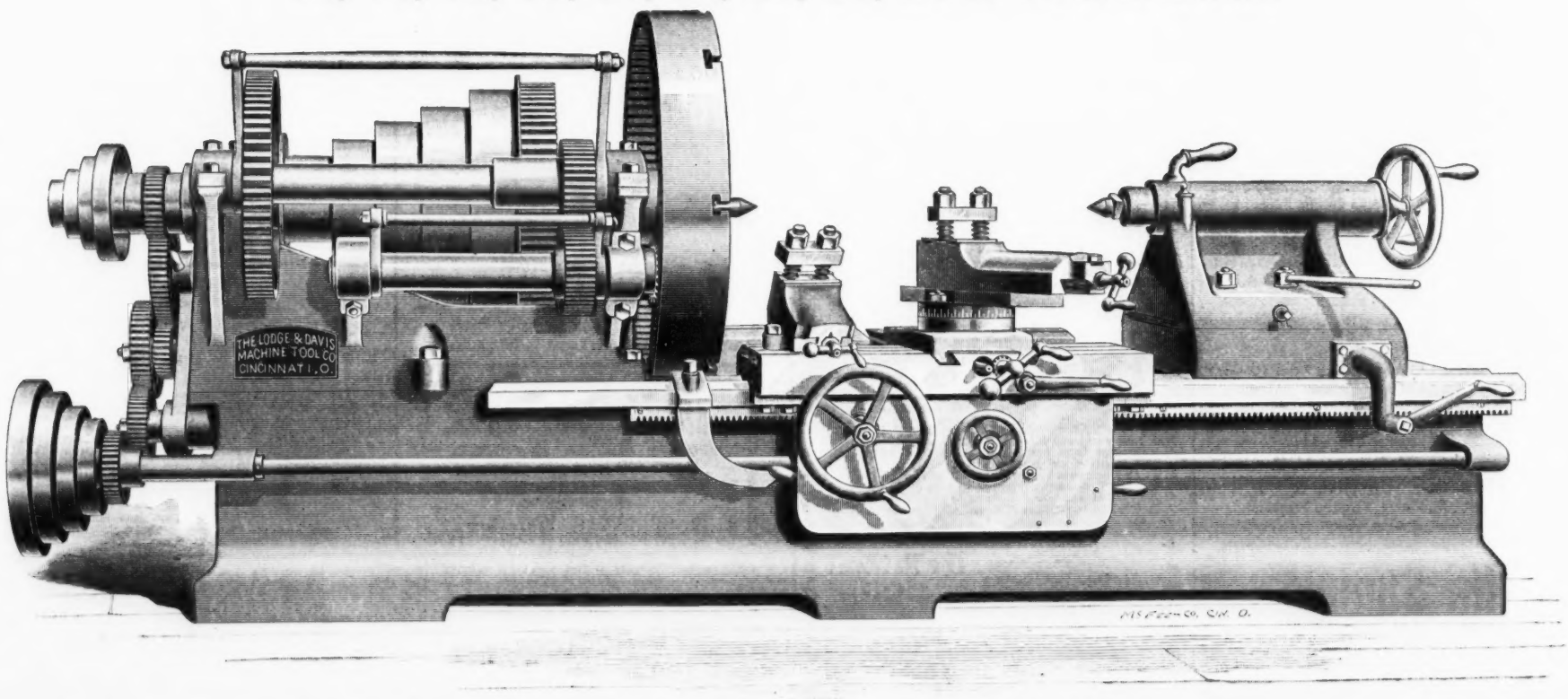


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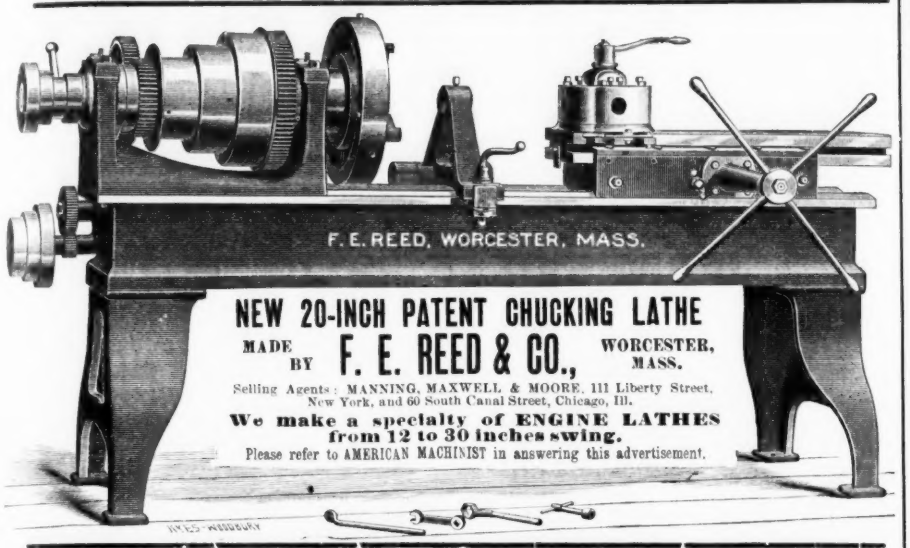


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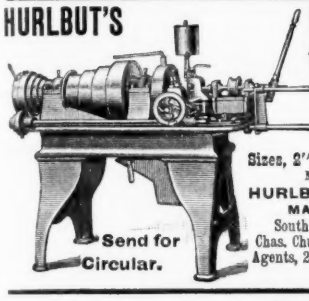

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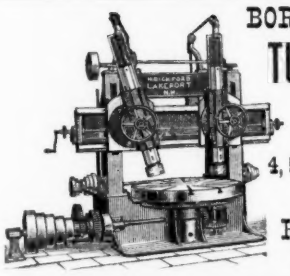

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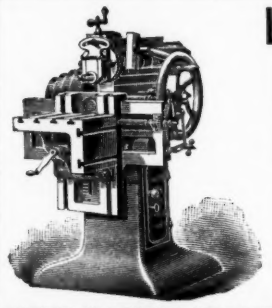

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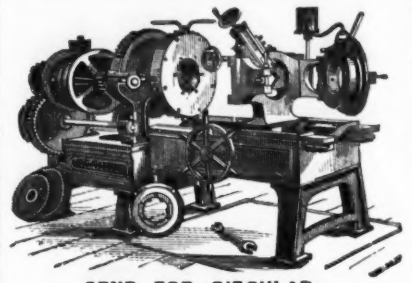

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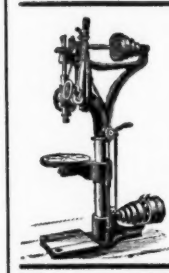

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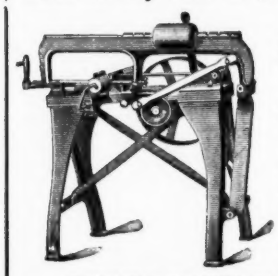

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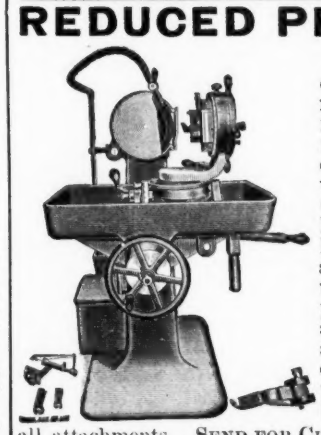

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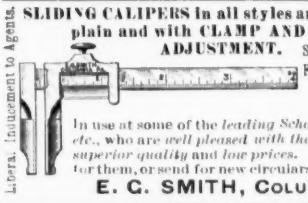

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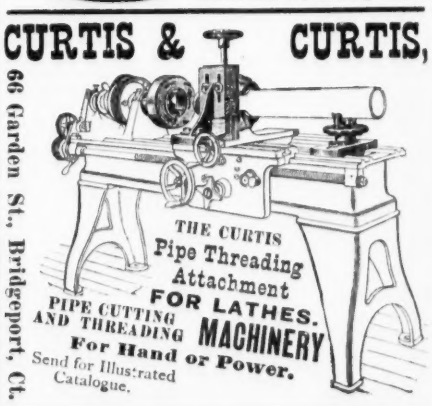

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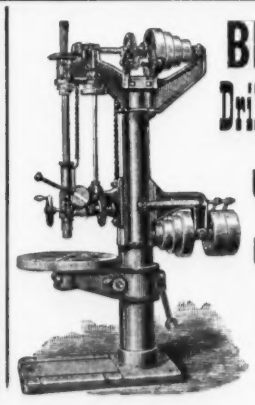

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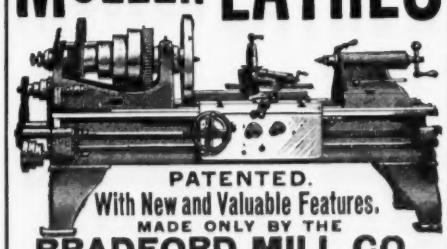

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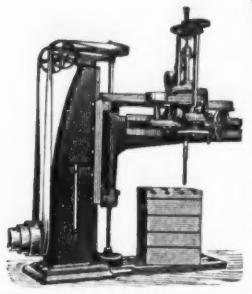

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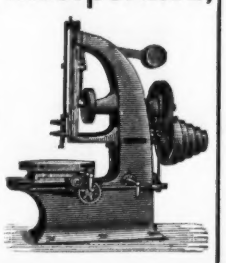

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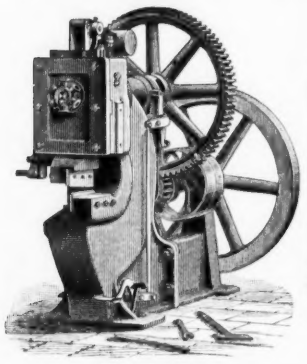

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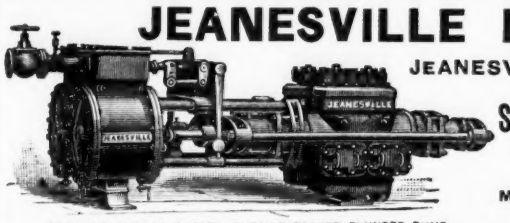

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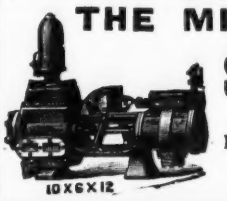

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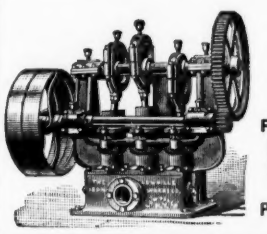

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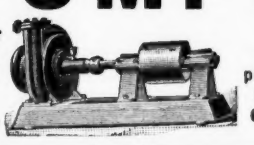

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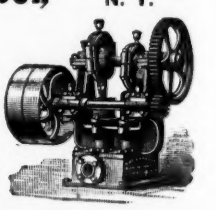

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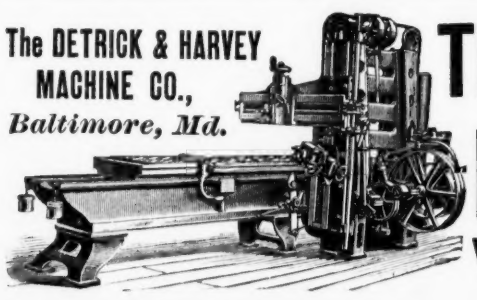

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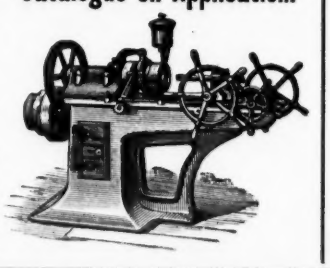

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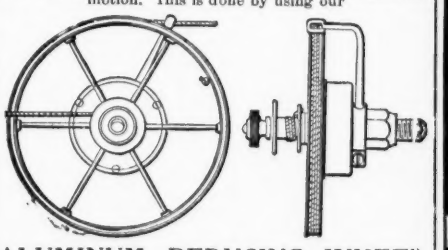

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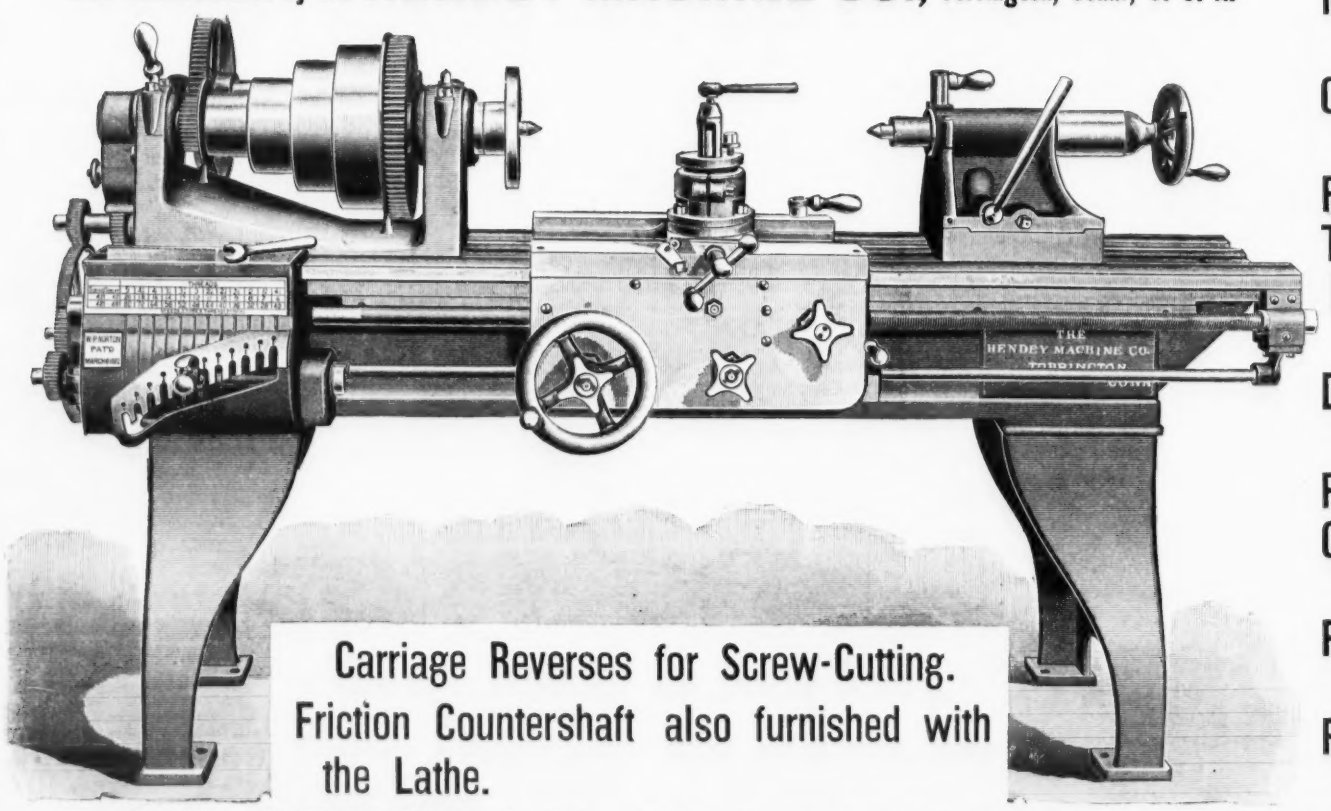


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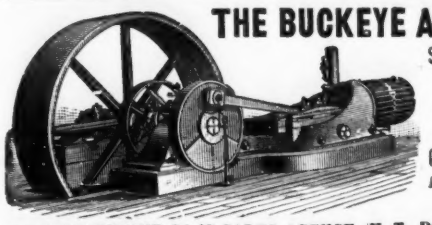

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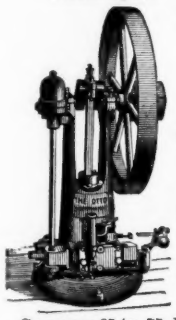

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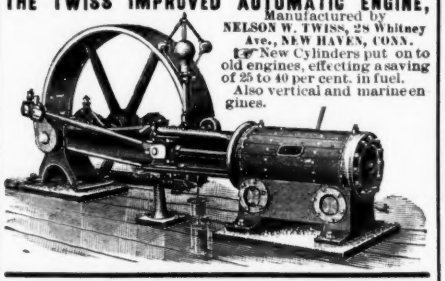

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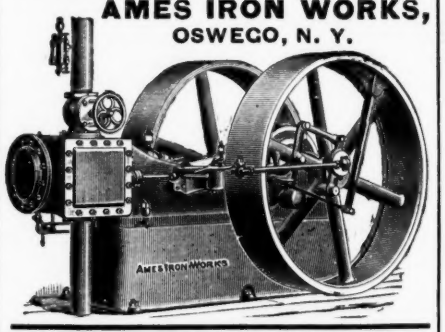

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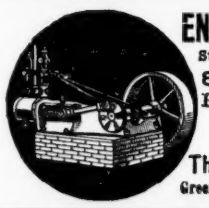

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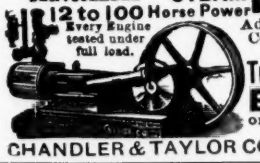

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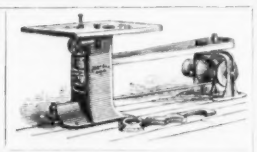

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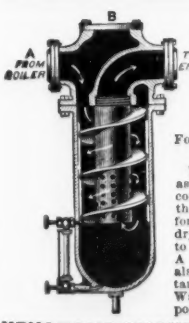

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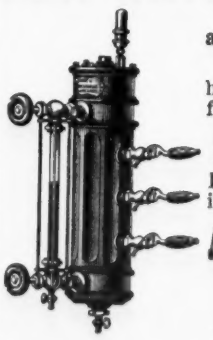

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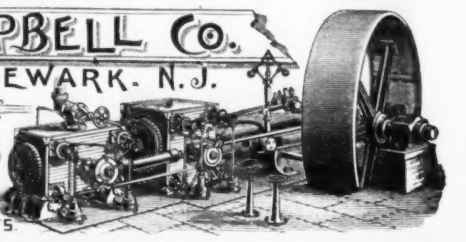

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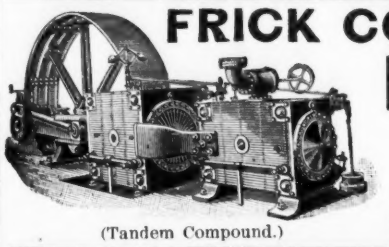

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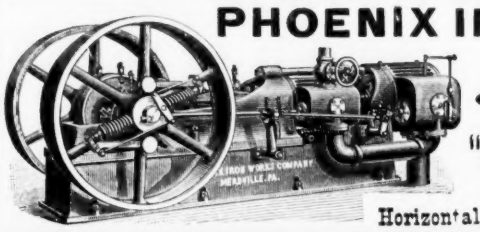

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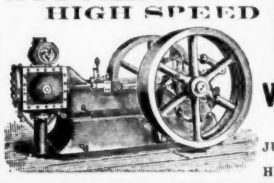

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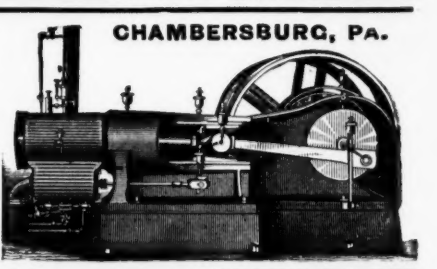

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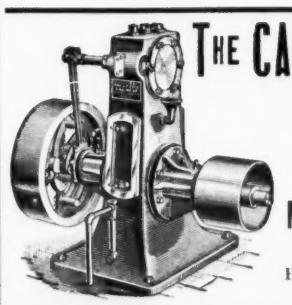

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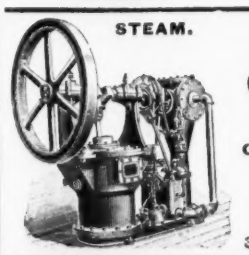

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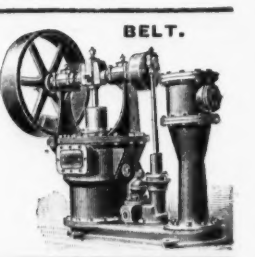

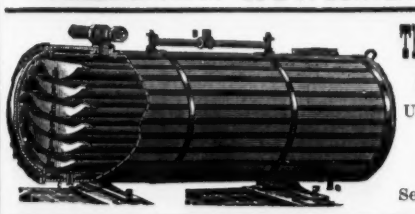

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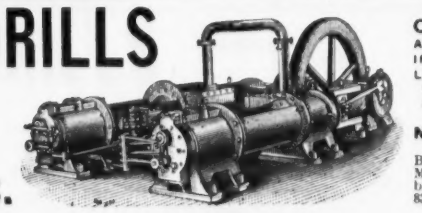

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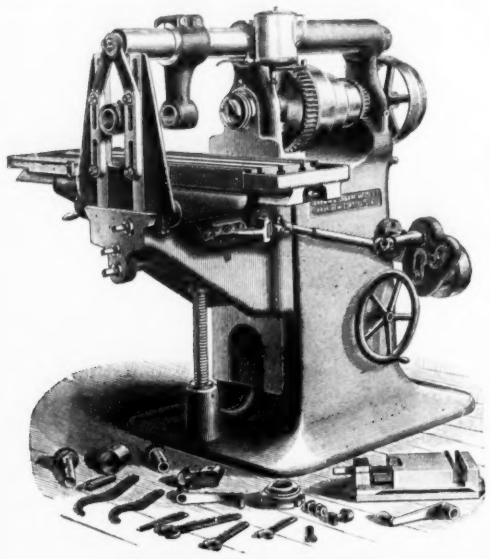

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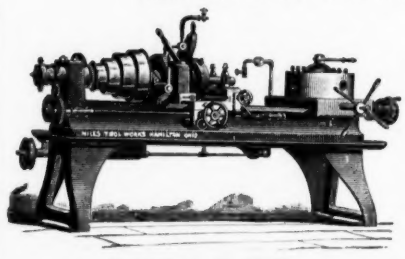

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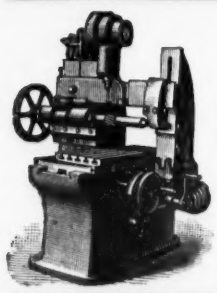

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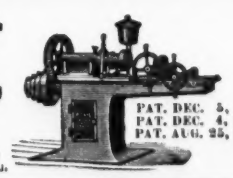

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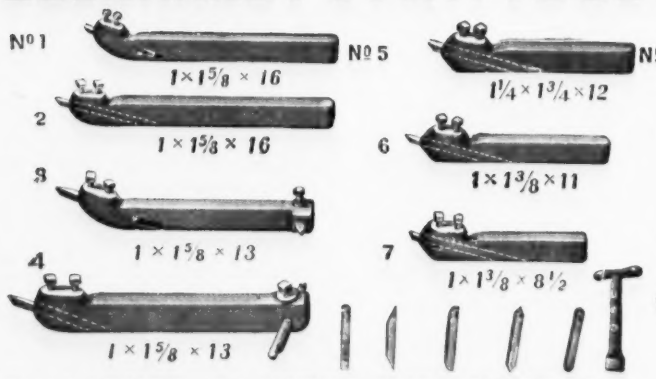


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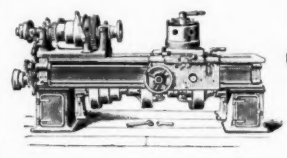

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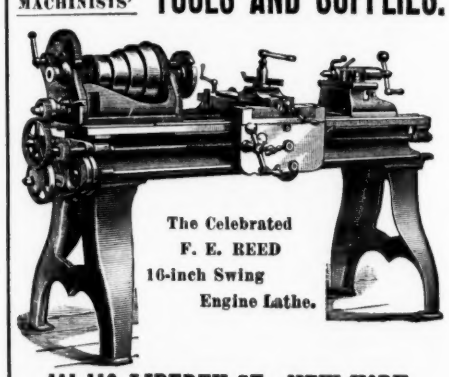

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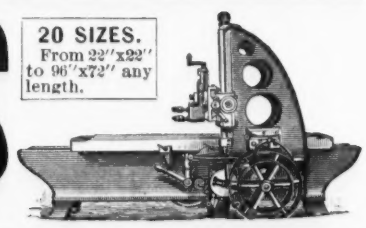

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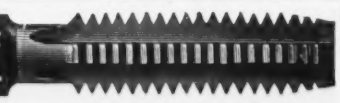

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